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Inventory of Existing Conditions

Introduction

Snohomish County Airport/Paine Field is the major general aviation/industrial aviation airport serving Snohomish County and several communities located in the northern portion of the Seattle Metropolitan Area (see Figure A1). The airport has been a catalyst that has brought The Boeing Company, Goodrich Inc., and other major aerospace companies to the County, providing a quite notable and prestigious employment base.

The area surrounding the airport, with many high quality homes and environmental amenities, has experienced significant residential development with the resulting homeowner concerns about the effect that the Airport may have on their lifestyle. Thus, the airport influences the social, economic, and physical environments of the area in which it operates. All of these effects must be carefully evaluated in considering airport development options.

Previous Paine Field planning studies include a Master Plan, which was completed in 1981, and an FAR Part 150 Noise Exposure and Land Use Compatibility Study, which was completed in 1986. These studies were updated by the existing Airport Master Plan for Paine Field completed in 1995. Local, regional, and national aviation issues have evolved significantly during the years that followed the completion of the last master planning effort. This evolution indicates that long-term planning considerations identified previously should be re-evaluated, and that an updated set of planning assumptions should be formulated. These assumptions will serve as a basis for airport development recommendations.

The purpose of this Airport Master Plan Update is to determine airport development needs, examine viable and reasonable alternatives, recommend a realistic plan, and identify potential environmental effects. The requirement for future facilities will be evaluated from an aviation utilization standpoint, along with consideration of the relationship of airport facilities to the surrounding community. The focus of the Master Plan Update is on the physical development of airport property to meet

aviation demands; however, consideration will also be given to the identification of potential non-aviation development areas on airport property. The overall planning goal is the development of an aviation facility that can accommodate future demand, is not significantly constrained by its environs, and minimizes its adverse effects on its surroundings.

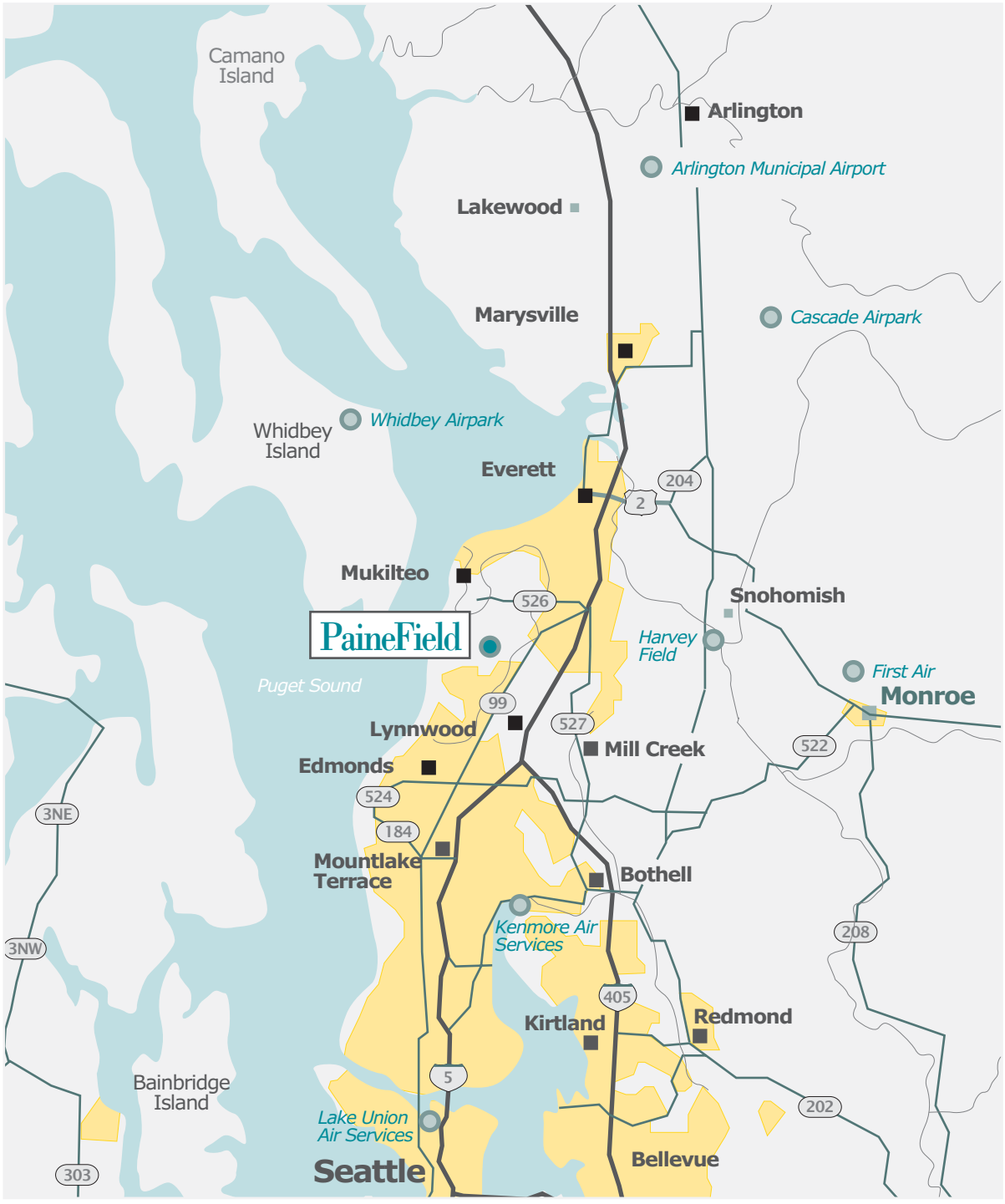
Airport History and Regional Aviation Environment

Paine Field began in 1936 as one of five WPA projects designed to employ people and construct new airports in the United States. In 1941, the partially completed facility was taken over by the Army Air Corps and developed as an interceptor base during World War II. In 1946, the Air Corps deactivated Paine Field and the property and buildings were deeded to Snohomish County. The Airport was operated as a county airport until 1951, when the Air Force acquired the Airport's south complex and developed these facilities as a tactical air defense base. In 1968, the federal government again decided to deactivate Paine Field and conveyed the majority of military property and facilities to Snohomish County.

The Boeing Company negotiated an agreement with Snohomish County for the use of Paine Field in 1966 and constructed the Everett 747 plant. Boeing's facilities expanded in 1978 with the decision to add the 767 to their family of jets and again in 1992 when additional plant and office space was needed to meet the demand of increased sales of existing aircraft and the new 777 jetliner.

In 1970, with the acquisition of the former Air Force buildings from the federal government, Paine Field implemented an aggressive promotion and leasing program to find viable tenants for former military facilities. By offering reasonable rental rates, the Airport leased all of these buildings to new and growing businesses. With the regional recession of the early 1970s (due in part to a soft aerospace market), the Airport provided a bright area of economic benefits that consisted of over ninety companies employing over 2,000 people.

Since World War II, Paine Field has been Snohomish County's largest general aviation airport. The previous Airport Master Plan, which began in 1976 and was completed in 1981, evaluated the activities that the Airport might accommodate and Paine Field's future role. The county adopted a role for Paine Field in 1978, which was modified in 1979 when the county adopted the recommendations agreed to by a mediated role panel of interested parties (a copy of the 1978 Role Determination and 1979 panel recommendation, along with a brief summary are included in the Appendix). This "Mediated Role Determination encouraged general aviation activity, repair of large aircraft, corporate and business aviation activity, and Boeing Company operations. Airline crew training and military operations were to be held to 1979 levels, and air freight activity was to be discouraged. The 1979 Mediated Role Determination provided for air taxi and commuter operations at Paine Field. San Juan Airlines established service between Paine Field and Portland in 1987.



Not To Scale

Figure A1 Airport Location Map

Source: **Microsoft Automap Streets Plus, 1997 Edition.**

MASTER PLAN UPDATE

PaineField SnohomishCountyAirport

This commuter airline experienced financial problems in 1988 and terminated all operations.

Regional Aviation Plans

Regional level airport system planning guidance is contained in the Regional Airport System Plan (RASP), a document prepared by the Puget Sound Regional Council. The current RASP for the central Puget Sound region was adopted by the Regional Council in 1988. That plan contained recommendations for capacity improvements at the region's general aviation airports, and began the lengthy process for decisions related to the region's commercial air passenger demand. An early step in the analysis and decision process was "Flight Plan", a study co-sponsored by the Puget Sound Regional Council and the Port of Seattle. Commenced in 1989, "Flight Plan" evaluated a wide range of regional alternatives for meeting demand, including enhancements at Sea-Tac, a two-airport multiple airport system, a three-airport multiple airport system, a new replacement airport (coupled with the closure of Sea-Tac), and no action. The Flight Plan recommendations included a three airport system with the following elements: (1) a third runway at Sea-Tac, (2) introduction of air carrier service in the northern portion of the region; and, (3) future air carrier service in the southern part of the region.

In 1993, and based on the results of the "Flight Plan" process, the Regional Council adopted Resolution A-93-03, a two-airport system as the region's preferred plan. The plan involved improvements at Sea-Tac Airport combined with a new supplemental airport. The 1993 decision launched a "Major Supplemental Airport Study", which sought to locate a new airport site in the central Puget Sound region. The study was co-sponsored by the Regional Council, the Port of Seattle, the Washington DOT, and the FAA. Resolution A-93-03 also eliminated small supplemental airports, including Paine Field, as preferred alternatives. In 1994, after an exhaustive study of potential sites, the Regional Council stopped any further study of new airport sites and affirmed its approval of the third runway at Sea-Tac, subject to the independent evaluation of noise and demand management conditions (expert panel" process) established in 1993. In 1996, after those independent evaluations had been completed, the Regional Council adopted Resolution A-96-02, which formally added planning for Sea-Tac's third runway to the Metropolitan Transportation plan, subject to additional noise reduction steps to reduce the airport's impacts on adjacent communities.

In 1998, the Puget Sound Regional Council began an update of its 1988 "Regional Airport System Plan (RASP)" focused on the region's general aviation airports. The RASP, scheduled to be completed in May 2001, provides direction for investments in the region's airport system for the next 20 years. The plan's primary directions are to preserve and maintain the existing airport infrastructure, provide for safety and standards improvements, enhance the system to meet growing and changing user

needs, and to provide additional aircraft storage capacity (primary hangars) at selected airports that have both the ability and willingness to accommodate growth. At Paine Field, the RASP supports investment in the facility as a major reliever airport, and includes most of the improvements identified in the 1995 Airport Master Plan. These include runway safety area improvements, obstruction program, NAVAIDS, new air traffic control tower, and additional aircraft hangars, as well as numerous identified off airport roadway improvement projects.

Recent Airport Development

In the past twenty years, over $50 million of new airfield construction has been completed at Paine Field. Over $30 million of these projects involved aeronautical improvements that were funded by the FAA under the Airport Improvement Program (AIP), which derives its money from aviation user fees. A new parallel general aviation runway and a new taxiway for the Airport's primary runway utilized over $12 million of this AIP funding, along with $15.8 million for Runway 16R/34L safety area improvements and the construction of Taxiway A-1 and Taxiway A-9.

In addition to the new aeronautical and industrial facilities constructed at the Airport, several major land leases were negotiated and tenants constructed large leasehold improvements on this property. Goodrich, the largest third party commercial aircraft repair and maintenance company in America, completed a 265,000 square foot hangar, office, and shop facility costing $16 million on sixteen acres of lease property in 1989. This growing aerospace company has also constructed a new 635,000 square foot office, hangar, shop, and warehouse facility, which was completed in 1993 at a cost of $81 million.

In 1988, Snohomish County sold The Boeing Company 68 acres of airport property for the expansion of the company's flight line. This property was essential for Boeing's increased production schedule for 747/767 aircraft and the new family of 777 jets. This has resulted in an on-going expansion of office and plant facilities totaling 5.6 million square feet at an estimated cost of some $1.6 billion.

General Airport Description and Existing Airport Facilities

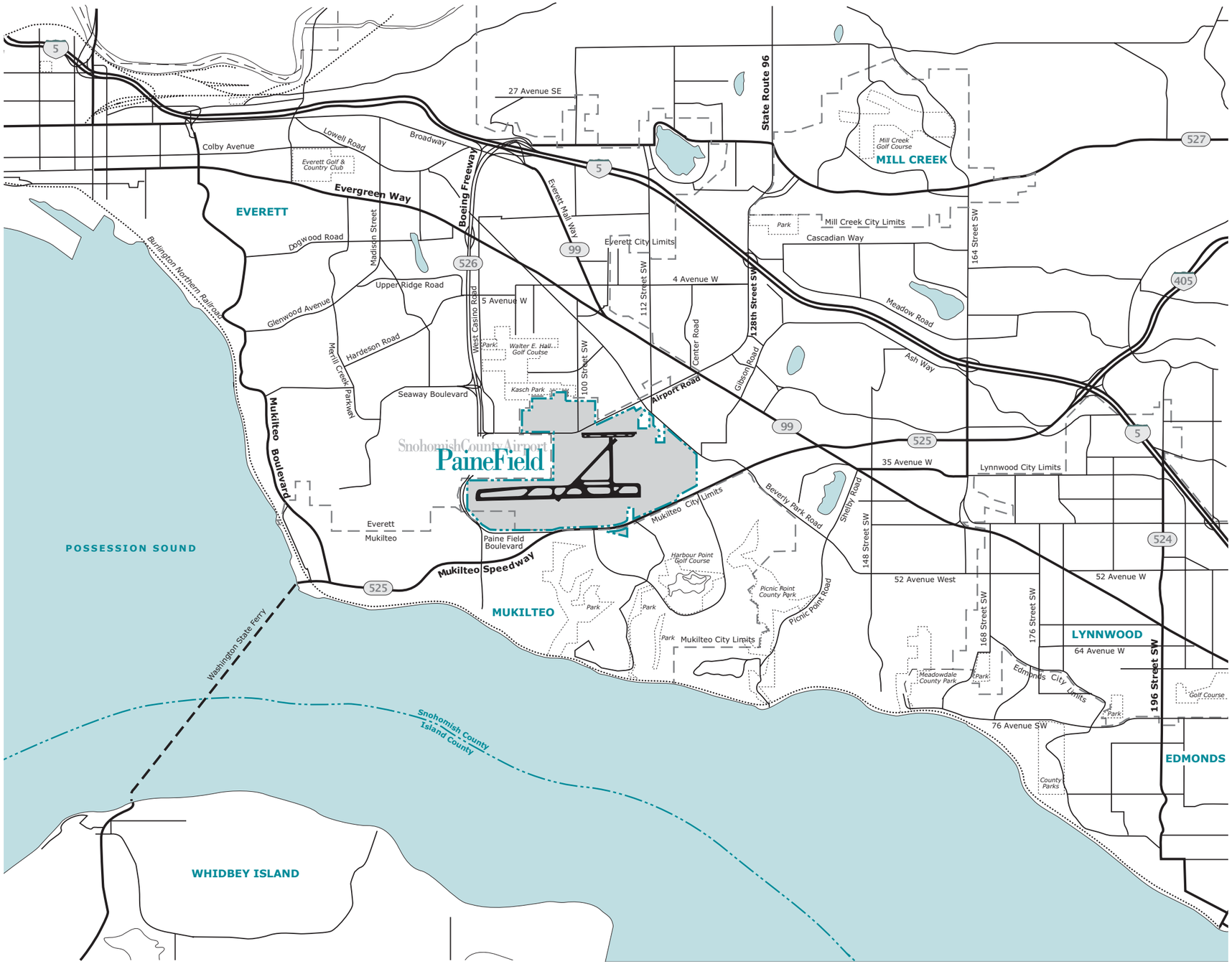
Paine Field Airport is owned and operated by Snohomish County, Washington. Under the direction of the County Executive and the County Council, the Airport Director and Staff supervise the day-to-day operation of the Airport. Paine Field is an enterprise department of Snohomish County and is mandated to generate all revenue necessary to operate and maintain the Airport. In the Federal Aviation Administration's (FAA's) *National Plan of Integrated Airport Systems* (NPIAS), it is designated as a general aviation reliever airport for Seattle-Tacoma International Airport. A Reliever Airport is a general aviation airport that is located in a metropolitan area and is intended to reduce congestion at a large commercial

service airport by providing general aviation pilots with alternative landing areas. In addition, Paine Field is a designated alternate landing site to Seattle-Tacoma International Airport for commercial service operators during fog or when weather conditions dictate.

The following figure, entitled *AIRPORT VICINITY MAP,* provides a graphic description of Paine Field's location in relation to surrounding communities and roadways in Snohomish County. Paine Field Airport is located approximately six miles southwest of the Everett Central Business District (CBD) and approximately twenty miles north of downtown Seattle.

The Airport Reference Point (ARP) is located at Latitude 47° 54' 25.388"N, Longitude 122° 16' 53.816"W. The airport elevation is 609.65 feet above mean sea level (AMSL) and has property consisting of approximately 1,284.3 acres. Paine Field has three runways, an extensive system of taxiways, aircraft parking aprons, hangars, a terminal building, and various other airport facilities. The following text and illustration, entitled *EXISTING AIRPORT LAYOUT*, provide verbal and graphic descriptions of the existing airport facilities.

Figure A2
Airport Vicinity Map



1" = 6,000'

MASTER PLAN UPDATE

PaineField SnohomishCountyAirport

Source: **Snohomish County Planning Department Mapping, Aerial Photography, and United States Geological Survey (USGS) Quadrangle Sheets.**

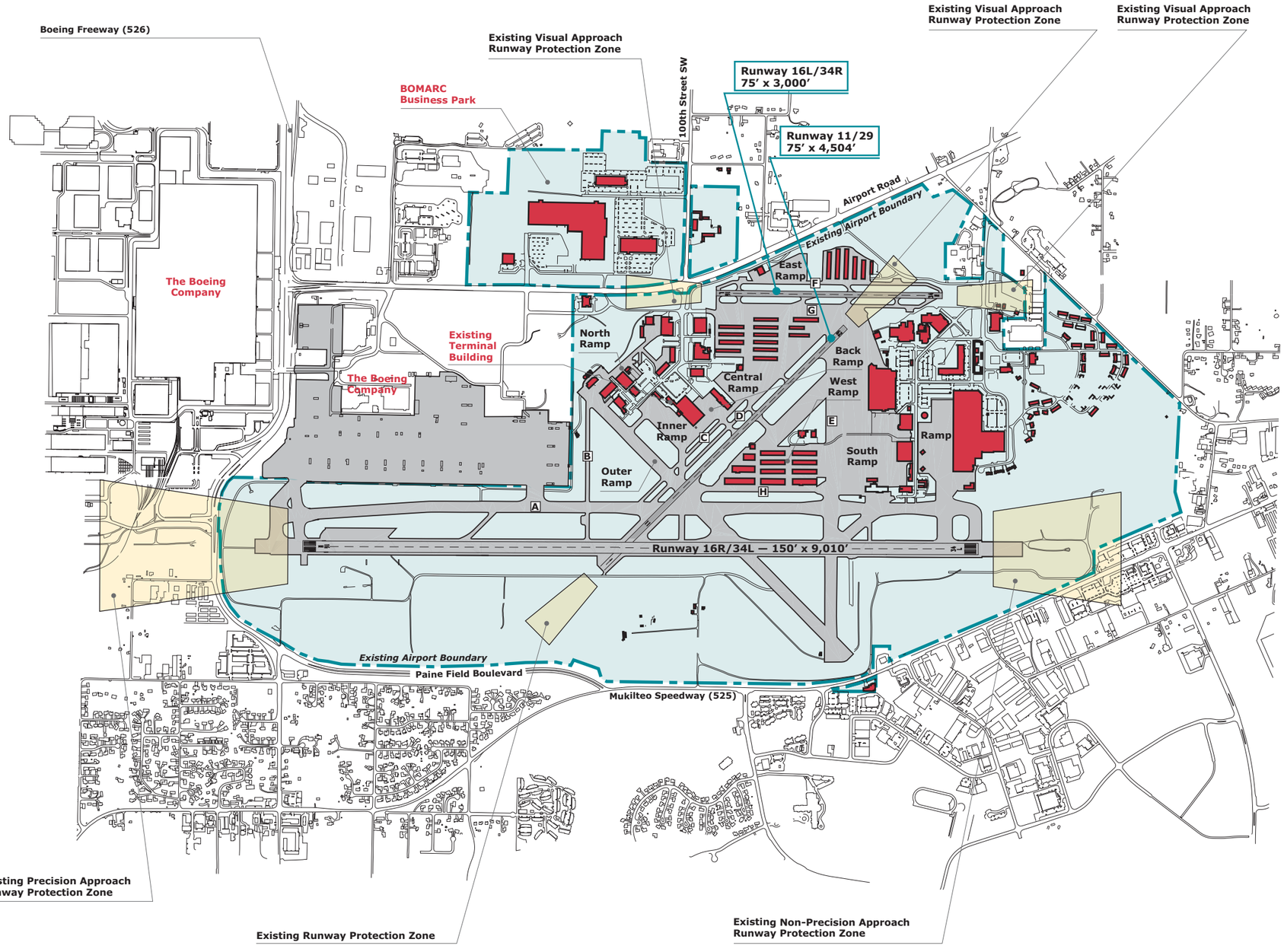


Figure A3
Existing
Airport Layout Plan

Not to Scale

Source: **Previously Prepared Airport Layout Plan, Barnard Dunkelberg & Company, October 2000.**

Federal Grants Summary

In addition to the original construction by the Federal Works Program Administration, and improvements made by the Army Air Corps and the U.S. Air Force, Snohomish County has received forty-two Federal grants for Paine Field improvements since 1949. Specific projects include:

Project 9-45-018-901 (1949). Grade, drain and ballast light plane apron; install high intensity lights on N/S runway. Federal participation - $24,094.

Project 9-45-018-902 (1949). Install additional drainage system on existing N/S runway and landing strip. Federal participation - $30,154.

Project 9-45-018-103 (1951). Grade, drain, and pave parking and service apron and stub taxiway. Federal participation - $9,452.

Project 9-45-018-6104 (1960). Construct secondary taxiway including two stub taxiways. Federal participation - $22,000.

Project 9-45-018-7005 (1969). Reconstruct, strengthen, and mark Runway 16/34, including drainage; modify ALS threshold and HIR lights. Federal participation - $269,412.

Project 7-53-0028-01 (1973). Relocation of building No. 1103 to provide line-of-site for ATCT; relocate HIRL, taxiway, and ALS controls to the new ATCT. Federal participation - $61,486.

Project 7-53-0028-02 (1974). Install wind cone; install VASI Runway 34; improve Runway 16/34 safety area; extend Taxiway F; install lighting taxiways C, D, F, and H; install taxiway guidance signs; install threshold lights and lenses for MIRL Runway 11/29. Federal participation - $89,157.

Project 7-53-0028-03 (1974). Acquire quick response fire/crash rescue (CFR) vehicle. Federal participation - $19,047.

Project PGPA-53-0028-01, 02, 03, 04 (1977, 1978, 1979, 1980). Preparation of conceptual development and environmental study portions of an Airport Master Plan. Federal participation - $354,195.

Project 5-53-0028-04 (1976). Convert structural fire tanker to CFR vehicle. Federal participation - $38,800.

Project 5-53-0028-05 (1977). Construct, mark, and light Taxiway F. Federal participation - $72,372.

Project 5-53-0028-06 (1978). Mark Runway 16/34. Federal participation - $23,949.

Project 5-53-0028-07 (1979). Construct, mark, and light taxiway G; acquire CFR proximity suits. Federal participation - $106,760.

Project 5-53-0028-08 (1980). Construct aircraft parking apron; install safety fencing, fabricate crash, fire, rescue vehicle. Federal participation - $423,500.

Project 7-53-0028-09 (1981). Rehabilitate and mark Runway 16/34; grade safety area Runways 16/34 and 11/29; install VASI-2 on Runway 11 and 29; pave aircraft parking area including tiedowns and marking; construct run-up apron Taxiway D; rehabilitate portion of Taxiway A. Federal participation - $2,152,461.

Project 3-53-0028-01 (1983). Construct, mark, and light Phase I Taxiway A. Federal participation - $944,472.

Project 3-53-0028-02 (1983). Site preparation for new Runway 16L/34R. Federal participation - $439,239.

Project 3-53-0028-03 (1983). Prepare FAR Part 150 Noise Compatibility Plan (Phase I). Federal participation - $49,438.

Project 3-53-0028-04 (1984). Complete FAR Part 150 Noise Compatibility Plan (Phase II). Federal participation - $75,202.

Project 3-53-0028-05 (1984). Construct, light, and mark Phase II Taxiway A. Federal participation - $1,536,809.

Project 3-53-0028-06 (1985). Acquire land; prepare site and remove obstructions for new Runway 16L/34R; construct apron; construct fencing. Federal participation - $2,702,079.

Project 3-53-0028-07 (1986). Complete Runway 16L/34R fill; construct access way; clear and grade clear zone Runway 16L; construct and light apron east of Runway 16L/34R and construct connecting taxiway. Federal participation - $1,386,111.

Project 3-53-0028-08 (1986). Acquire land for development; complete construction of Runway 16L/34R; complete construction of runway and taxiway lighting; complete fencing; construct T-hangar taxiway; relocate East Army Way. Federal participation - $708,768.

Project 3-53-0028-09 (1986). Design Phase III Taxiway A. Federal participation - $72,832.

Project 3-53-0028-10 (1987). Construct Phase III Taxiway A. Federal participation - $1,563,659.

Project 3-53-0028-11 (1988). Purchase noise monitoring equipment; improve north and south safety areas; construct taxiways A-2 and D-1. Federal participation - $1,094,862.

Project 3-53-0028-12 (1989). Construct access road, construct Taxiway G-3, strengthen Taxiways A-5, A-6 and E. Federal participation - $755,588.

Project 3-53-0028-13 (1989). Strengthen Taxiways A-3, A-4, C, and D. Strengthen main terminal aprons and east apron. Federal participation - $863,120.

Project 3-53-0028-14 (1990). Signage Phase I, security gates, lighting controls. Federal participation - $320,785.

Project 3-53-0028-15 (1991). Taxiway F south construction, Phase II signage. Federal participation - $241,182.

Project 3-53-0028-16 (1992). Signage, Phase III; rehabilitate HIRL Runway 16R/34L. Federal participation - $971,816.

Project 3-53-0028-17 (1992). Master Plan and Environmental Assessment. Federal participation - $200,000.

Project 3-53-0028-18 (1993). Runway 16R/34L and Taxiway Alpha shoulders. Federal participation - $2,732,270.

Project 3-53-0028-19 (1994). Runway 16R/34L resurfacing. Federal participation - $2,300,000.

Project 3-53-0028-22 (1996). Reconstruct Runway 34L. Federal participation - $1,434,147.

Project 3-53-0028-23 (1996). Reconstruct Taxiway A7. Federal participation - $233,853.

Project 3-53-0028-25 (1998). Runway 16R/34L Safety Area Improvements. Federal participation - $4,642,452.

Project 3-53-0028-26 (1998). Runway 16R/34L Safety Area Improvements. Federal participation - $1,495,000.

Project 3-53-0028-27 (1999). Runway 16R/34L Safety Area Improvements. Federal participation - $3,450,000.

Project 3-53-0028-28 (1999). Runway 16R/34L Safety Area Improvements. Federal participation - $3,881,139.

Project 3-53-0028-29 (1999). Runway 16R/34L Safety Area Improvements. Federal participation - $471,976.

Project 3-53-0028-30 (1999). Runway 16R/34L Safety Area Improvements. Federal participation - $3,000,000.

Project 3-53-0028-31 (2000). Master Plan Update. Federal participation - $233,492.

Project 3-53-0028-32 (2001). Rehabilitate Runway 16R/34L Centerline. Federal participation - $360,000.

Project 3-53-0028-33 (2001). Construct Runway 16R/34L Safety Area. Federal participation - $730,076.

Project 3-53-0028-34 (2002). West Ramp Hangar Development. Federal participation - $2,000,000.

Airside Facilities

Runways. The main runway at Paine Field is Runway 16R/34L. It is 9,010 feet in length, 150 feet in width, constructed of grooved asphalt, and has a gross weight bearing capacity of 100,000 pounds for single-wheel, 200,000 pounds for dual-wheel, 350,000 pounds for dual tandem-wheel, 722,000 pounds for dual tridem, and 830,000 pounds for double dual tandem-wheel main landing gear configuration aircraft. The runway is equipped with High Intensity Runway Edge Lights (HIRL) and in-pavement centerline lights. Runway 16R has Precision Approach Path Indicator (PAPI) lights and an Instrument Landing System (ILS) [consisting of Glide Slope, Localizer, and Medium Intensity Approach Lighting with Runway Alignment Indicator Lights (MALSR)]. In addition, Precision Approach Path Indicator (PAPI) lights and a Medium Intensity Approach Lighting with Sequential Flashers (MALSF) are provided for Runway 34L. Safety area improvement projects currently underway will allow Runway 16R/34L to be maintained at a length of 9,010 feet in the future.

The secondary parallel runway is Runway 16L/34R. It is 3,000 feet in length, 75 feet in width, constructed of asphalt, and has a gross weight bearing capacity of 12,500 pounds for single-wheel main landing gear configuration aircraft. This runway has Medium Intensity Runway Lights (MIRL) and PAPI lights, along with Runway End Indicator Lights (REILS) serving both ends.

The crosswind runway is Runway 11/29. It is 4,504 feet in length, 75 feet in width, constructed of asphalt, and has a gross weight bearing capacity of 40,000-50,000 pounds for single-wheel and 55,000-75,000 pounds for dual-wheel main landing gear configuration aircraft. This runway has MIRL and VASI lights serving both runway ends. The northwest threshold of Runway 11/29 is displaced by 799 feet.

Taxiways. Additional airside facilities at Paine Field include the taxiway system that provides access between the runway and the various landside areas. Additional taxiways consist of:

- Taxiway A and connectors: the full-parallel taxiway system on the east side of Runway 16R/34L.
- Taxiway B: a connecting taxiway, providing access from Taxiway A to the north ramp and outer terminal ramp.
- Taxiway C: partial parallel taxiway on the northeast side of Runway 11/29.
- Taxiway D: full parallel taxiway northeast of Runway 11/29 and southwest of Taxiway C.
- Taxilane E: the east/west access taxilane connecting the parallel runways, along with providing access to the south, central, and west ramps.
- Taxiways F and G: full parallel taxiway serving Runway 16L/34R, with Taxiway F being on the east side of the runway and Taxiway G on the west side.
- Taxilane H: a north/south taxilane providing access between Runway 11/29 and Taxilane E.

In addition, Taxiways K-5 and K-6 are connecting taxiways on the west side of Runway 16R/34L, providing access to the west side aviation use areas.

Landside Facilities

Landside facilities vary from one airport to another and can be categorized differently depending on the purpose of the documentation. For the purpose of this report, landside facilities will include aircraft parking aprons, aircraft storage hangars, maintenance hangars, terminal facilities, air traffic control tower facilities, fuel storage facilities, automobile access/parking, etc. Each of these components is discussed in the following narrative, and is illustrated in the preceding figure, entitled *EXISTING AIRPORT LAYOUT*.

Aprons. Paine Field has several apron areas for aircraft parking and storage. The largest is the Boeing Ramp, which is located north of the terminal area and east of the approach end of Runway 16R (the Boeing Ramp is not actually on airport property but is provided with access to Taxiway A). Other aprons include:

- The Terminal Ramp is divided into three components - the Outer Terminal Ramp, on the northwest; the Inner Terminal Ramp, located directly adjacent to the terminal building; and the Back Terminal Ramp, on the south.

- The Central Ramp is located southeast of the terminal, and contains several sets of T-hangars.
- The Goodrich ramp is situated at Goodrich Hangar 3, on the south end of airport property, east of Runway 16R/34L.
- The South Ramp, north and west of Goodrich Hangar 1, is located between Runways 16L/34R and 11/29.
- The West Ramp is located on the southwest side of Runway 11/29 and also contains T-hangar type structures.
- The East Ramp is located on the east side of Runway 16L/34R.
- The North Ramp is located northeast of the terminal.

Aircraft Storage and Aviation Use Facilities. A majority of the airport's aircraft storage facilities is concentrated in the central portion of airport property between the parallel runways. Facilities located adjacent to the various ramp areas include:

- The North Ramp - facilities associated with Everett Community College, University of Washington, and the Museum of Flight, as well as private hangar structures.
- The West Ramp - facilities consist primarily of T-hangar structures and larger twin-engine aircraft condo-hangars.
- The Central Ramp - accommodates mostly T-hangar structures.
- The East Ramp - contains one commercial hangar structure and six T-hangar structures.

Terminal Building. The terminal building, which contains airport management offices, along with aviation related business offices, is located adjacent to the Inner Terminal Ramp, between the parallel runways, north of Runway 11/29. Automobile parking is located on the east side of the terminal building.

Aircraft Rescue and Fire Fighting. The Aircraft Rescue and Fire Fighting (ARFF) facility is located in the southwest corner of the south ramp, adjacent to Taxiway A. The airport is classified as an Index A airport, and satisfies the associated criteria and requirements with its ARFF equipment and staff. An index A airport can accommodate five or more daily departures by air carrier aircraft, which are less than ninety feet in length.

Air Traffic Control Tower. The Air Traffic Control Tower (ATCT) is located southeast of the terminal building adjacent to the Inner and Back Terminal Ramps. The FAA operates the ATCT facility at Paine Field seven days a week, between the hours of

7:00 a.m. and 9:00 p.m. A new ATCT is currently under construction northwest of the Inner Terminal Ramp.

Other Landside Facilities. Other airport facilities include:

- The Boeing Company Plant. Although these facilities are off airport property, they are located adjacent to airport property, east of Runway 16R/34L, north of the North Ramp.
- Goodrich Facilities. Goodrich utilizes three large hangar facilities on airport property. The first of these is located on the B.F. Goodrich Ramp, adjacent to the south end of Runway 16R/34L. The second is on the east side of the South Ramp, and the third is adjacent to the Inner Terminal Ramp. In addition, B.F. Goodrich operates ancillary facilities in several other buildings on the airport.
- Bomarc Industrial/Business Park. This development area is located on the eastern portion of airport property, north of 100th Street S.W. and east of Airport Road. Occupants include The Boeing Company and Goodrich.

Fuel Storage Facilities. There are numerous fuel storage facilities located on the airport. The following table, entitled *FUEL STORAGE FACILITIES,* provides a description of the fuel facilities at Paine Field.

Table A1
FUEL STORAGE FACILITIES
Paine Field Master Plan Update

Location	Number of Storage Tanks	Aboveground/ Underground	Total Capacity (Gallons)	Type
North Ramp	6	Aboveground	360,000	Jet-A
North Ramp	1	Aboveground	20,000	AvGas
Inner Terminal Ramp	1	Underground	2,000	Auto Gas
Inner Terminal Ramp	1	Underground	2,000	Deisel
Inner Terminal Ramp	3	Underground	30,000	AvGas
Central Ramp	1	Underground	15,000	AvGas
Outer Terminal Ramp	1	Underground	15,000	Jet-A
Boeing Ramp	1	Aboveground	1,029,000	Jet-A
Boeing Ramp	4	Aboveground	240,000	Jet-A

Source: Paine Field Personnel.

Ground Access

As an employment center and to facilitate air travelers, ground access is an important element in the overall ability of an airport to function properly. The ground access system serving the Paine Field area is shown on the following illustration, entitled *ARTERIAL CIRCULATION MAP*, and described in the following text.

Interstate Highways. Interstate Highway 5 (I-5), which runs north/south, is a limited access highway approximately four miles east of the airport, thereby, providing good access to the nation's Interstate Highway System.

State Routes/Major Streets. Three State Routes (SR) and one principal arterial provide access between I-5 and the airport area. SR 526 (Boeing Freeway) is an east/west controlled access roadway that is adjacent to the north side of airport property, providing the primary access to Boeing facilities. Providing direct access to the west side of the airport, Paine Field Boulevard and SR 525 (Mukilteo Speedway) tie in with I-5 and I-405 approximately five miles southeast of the airport and with SR 526 at the northwest corner of the airport. In addition, SR 99, a southeast/northwest travel corridor, is located east of the airport and connects SR 525 and SR 526. Major upgrades to these roads, including SR 526/I-5 interchange, SR 525/SR 99 interchange, and new Paine Field Boulevard, have recently been completed. Additionally, widening of SR 525 is planned for 2001/2002.

The Airport Road/128th Street SW corridor provides the most direct access to the terminal entrance and passes through the east side of airport property. Airport Road connects with I-5 approximately three miles southeast of the airport and with Boeing Freeway (SR 526). The number of travel lanes currently provided by Airport Road/128th Street SW varies between I-5 and SR 526; however, because of the high traffic volume related to Boeing shift changes, reserved carpool lanes have been established for this entire segment of Airport Road/128th Street SW. East of I-5, 128th Street SW is designated SR 96.

City Streets/Airport Access. Direct landside access to airport property is provided by a series of streets. Access to the terminal area is provided by 100th Street SW. Access to the east ramp area is provided by 106th Street SW and Minuteman Lane. Access to the South Industrial Complex/B.F. Goodrich area is provided by 112th Street SW, along with Minuteman Lane.

Figure A4
Arterial Circulation Map

Airport Property
Freeway
Principal
Major Collector
Minor Collector

1" = 6,000'

MASTER PLAN UPDATE

Source: **Snohomish County Planning Department Mapping, Aerial Photography, and United States Geological Survey (USGS) Quadrangle Sheets.** Arterial Circulation Map: **Snohomish County West 1/3 Arterial Circulation Map.**

Airport Environs

Paine Field is located in an unincorporated area of Snohomish County. The northern and eastern portion of airport property abuts the City of Everett, while the western portion of airport property abuts the City of Mukilteo. The corporate boundaries of the cities of Lynnwood and Edmonds are approximately three miles to the south of airport property. The relationship of Paine Field to the surrounding cities is illustrated in the following figure, entitled *AIRPORT ENVIRONS MAP.*

The following narrative provides a general description of the existing land uses, land use zoning, and future land uses in the area surrounding Paine Field. A proper inventory of existing zoning patterns within the environs of an airport, along with existing land use, and future land use is important in an airport planning effort so as to ensure land use compatibility with future airport development.

Existing Zoning

Generalized existing zoning within the vicinity of Paine Field is illustrated in the following figure, entitled *GENERALIZED EXISTING ZONING,* reflecting the zoning designations of the cities of Everett and Mukilteo, along with those for the unincorporated areas of Snohomish County. For purposes here, zoning is categorized into the following types: residential, commercial (including office), industrial, and open/parks. The airport itself is zoned light industrial.

In the area north of the airport, there is a large manufacturing/industrial and office zoning tract associated with the Boeing facilities. The area north of the airport and adjacent to Possession Sound is primarily zoned residential. Some commercial zoning does exist north of the airport associated with the ferry landing and at the intersection of Mukilteo Speedway and Mukilteo Boulevard.

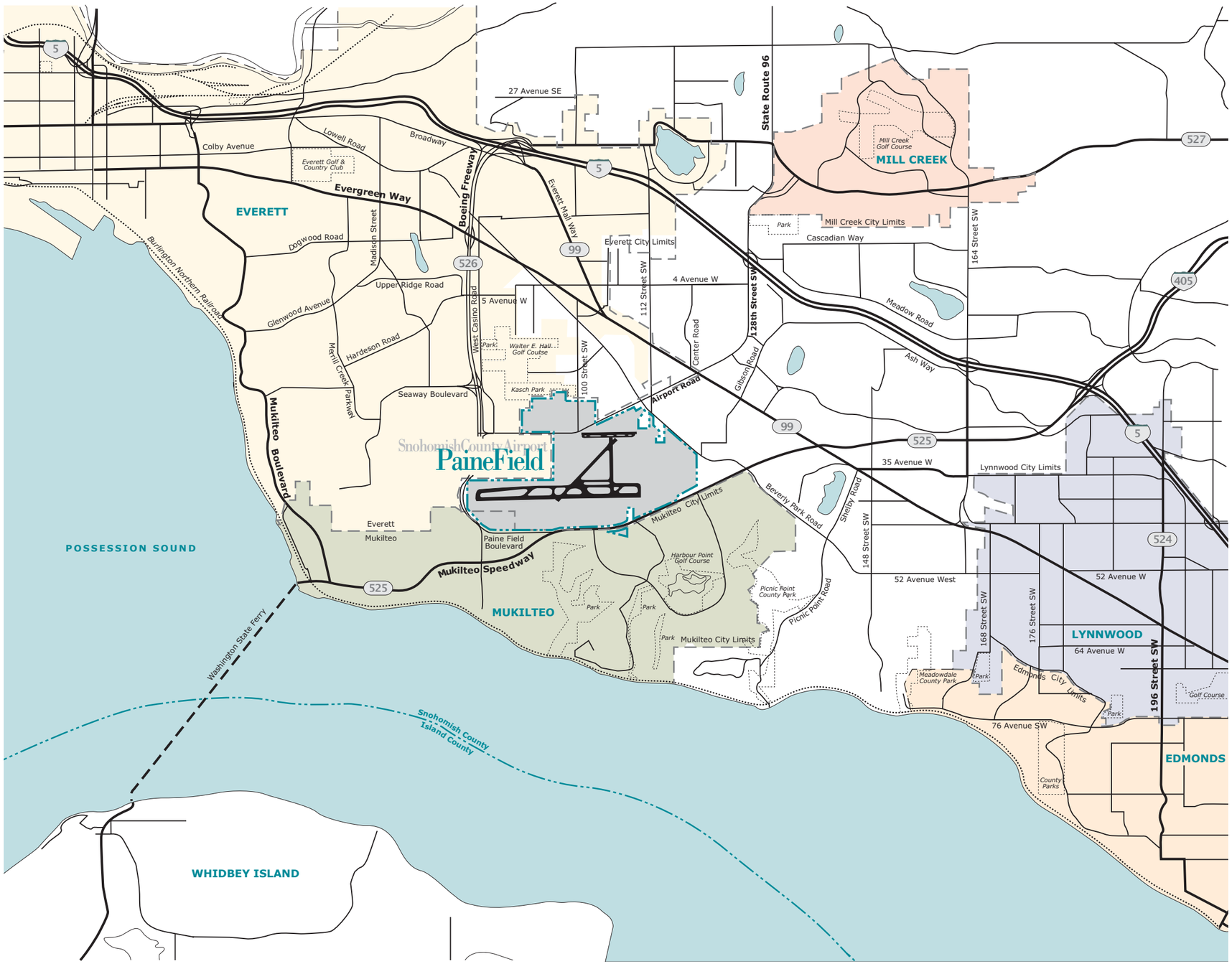
The area east of the airport is characterized by residential zoning with strips of commercial zoning along the major roadways; i.e., SR 99 and Airport Road. In addition, Kasch Park and Walter E. Hall Golf Course are located directly east of airport property, south of Casino Road.

The area directly southeast of the airport is dominated by business park and residential zoning, while southwest of the airport, zoning uses along the Mukilteo Speedway are characterized by a combination of general commercial, community business, industrial, and manufacturing. General commercial and community business zoning extend laterally along SR 99. The area south of the airport is dominated by various residential uses, with dispersed areas of commercial and industrial zoning.

Figure A5

Airport Environs Map

- Edmonds
- Everett
- Lynnwood
- Mill Creek
- Mukilteo



1" = 6,000'

MASTER PLAN UPDATE

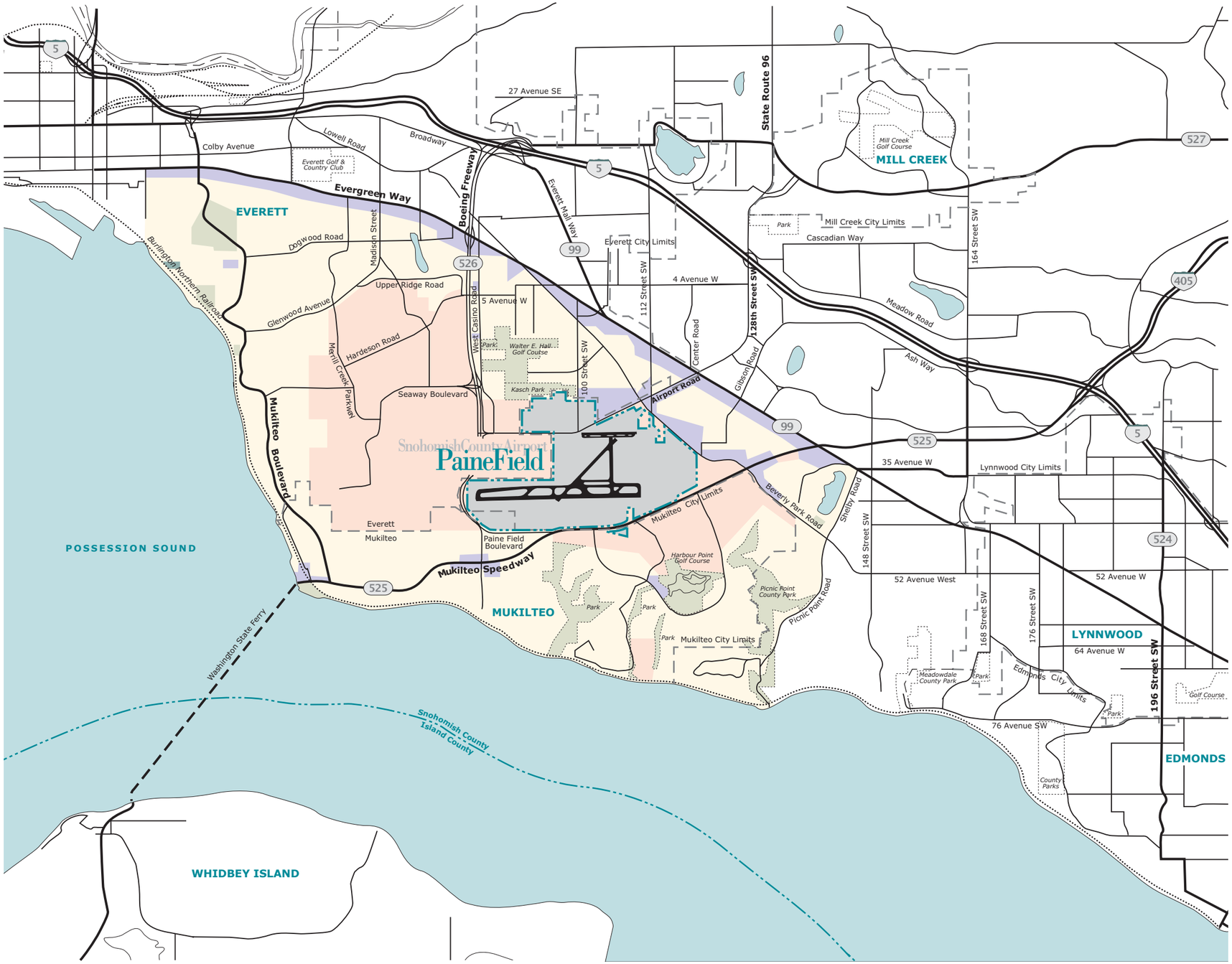
PaineField SnohomishCountyAirport

Source: **Snohomish County Planning Department Mapping, Aerial Photography, and United States Geological Survey (USGS) Quadrangle Sheets.**

Figure 6

Generalized Existing Zoning

- Airport Property
- Residential
- Commercial
- Industrial/Office Park
- Parks/Open Space
- Outside of Study Area



1" = 6,000'

MASTER PLAN UPDATE

PaineField SnohomishCountyAirport

Source: **Snohomish County Planning Department Mapping, Aerial Photography, and United States Geological Survey (USGS) Quadrangle Sheets.** Zoning:**Snohomish County Zoning Map.**

Within Mukilteo, west of the airport, lies the Harbour Pointe Community zoned primarily for residential uses, with several areas of park/open space and community business. In the northwest portion of Mukilteo, zoning consists of waterfront mixed use and downtown business district.

Existing Land Use

As illustrated in the following figure, entitled *GENERALIZED EXISTING LAND USE*, land use basically reflects existing zoning. In the area directly adjacent to the airport, industrial and commercial uses prevail; one notable exception is the residential area west of Paine Field Boulevard. Commercial uses are found along major arterials and at the intersections of these arterials. Densities of residential use vary in the area, but generally reflect single-family, suburban development with areas of open space. Additionally, significant clusters of multi-family development exist laterally along Casino Road, between Airport Road and SR 99; along 112th St. SW, between SR 99 and I-5; and along 128th St. SW, between SR 99 and I-5. The waters of Possession Sound are located approximately one and one-half miles west of the airport property and approximately two miles north of the airport. In addition, it should be noted that there is a substantial amount of land that is undeveloped or dedicated to parks/open space in the vicinity of the airport.

Several large tracts of undeveloped land exist within the environs on the airport. Some of these are associated with parks, or areas with limited development potential because of steep slopes or drainage features. There are two large open spaces near the airport; the west side of airport property and the area directly north and west of The Boeing Company plant.

Future Land Use

Generalized future land use within the vicinity of Paine Field is illustrated in the following figure, entitled *GENERALIZED FUTURE LAND USE*. Information supplied by Snohomish County shows that Paine Field has been designated as urban industrial. Urban Commercial is adjacent to SR 99, on both the east and west portions, extending from 112th St. SW to164th St. SW. Situated between SR 99 and Beverly Park Road, urban medium density residential is the dominant classification, with a small pocket of urban high density residential. South and east of SR 99, various densities of residential use make up future land uses. Several "Centers Designations" have been established at various locations in and around Paine Field. These centers represent the focal point of commercial and employment activity and include: Paine Field Airport, the intersection of Airport Road and SR 99, the converging point of Mukilteo Speedway, SR 99, and SR 525, the intersection of 128th St. SW and Interstate 5 (I-5), and the intersection of Interstate 5 (I-5) and 164th St. SW.

Figure 7
Generalized Existing Land Use

- Airport Property
- Residential
- Commercial
- Industrial/Office Park
- Undeveloped/Parks/Open Space
- Schools
- Outside of Study Area

1" = 6,000'

MASTER PLAN UPDATE

Paine Field Snohomish County Airport

Source: **Snohomish County Planning Department Mapping, Aerial Photography, and United States Geological Survey (USGS) Quadrangle Sheets.** Existing Land Use: **Field Surveys.**

Figure 8

Generalized Future Land Use

- Airport Property
- Residential
- Commercial
- Industrial/Office Park
- Parks/Open Space
- Outside of Study Area

1" = 6,000'

MASTER PLAN UPDATE

Paine Field Snohomish County Airport

Source: **Snohomish County Planning Department Mapping, Aerial Photography, and United States Geological Survey (USGS) Quadrangle Sheets.** Future Land Use: **City and County Comprehensive Plans.**

Southwest/west of Paine Field, an approximate 1/3 to 1/2 mile band of commercial and light industrial tracts parallel the Mukilteo Speedway. Further west, extending down to Puget Sound are the Harbour Pointe Golf Club, multi-family, and single family residential land uses. West and northwest of Paine Field, land uses consist mostly of single family residential with small pockets of commercial and parks/open space.

Other Site Characteristics

In addition to airside and landside facilities, several other physical characteristics of the airport, which may impact the formulation of planning recommendations, have been inventoried. These include soil characteristics, utilities, and pavement analysis.

Soils

Soil types occurring at Paine Field are listed in the following table, entitled *Paine Field Soils*.

Table A2
PAINE FIELD SOILS
Paine Field Master Plan Update

Type Number	Description	Limitations
1	Alderwood Gravelly Loam 2 to 8% Slope	Perched seasonal water table, erosion.
5	Alderwood Urban Land Complex 2 to 8% Slope	Perched seasonal water table, runoff slow, erosion.
6	Alderwood Urban Land Complex 8 to 15% Slope	Perched seasonal water table, moderately rapid runoff, erosion.
32	McKenna Gravelly Silt Loam 0 to 8% Slope	Poorly drained, seasonal ponding, limit construction to drier part of the year.
34	Mukilteo Muck	Very deep, very poorly drained, organic, not suited to urban development.
69	Terric Medisaprists, nearly level	Very deep, very poorly drained, organic, season high water table.
78	Urban Land Complex	This map unit consists of nearly level ground to gently sloping areas. Due to its generally developed nature, no specific classifications can be identified. Base soil types range from Alderwood and Everett to Tokul soils. Major portions of airport property classified under this unit are imported or constructed.

Source: *U.S. Department of Agriculture Soils Conservation Service Survey of Snohomish County,* 1983.

Of the soils listed, only Mukilteo Muck and Terric Medisaprists soils present insurmountable limitations to uses in development. This is primarily due to soil type and proximity to water. These soils are generally associated with wetlands and are used for wildlife habitat. These soil types are limited to relatively small areas on the south and east portions of airport property. The majority of airport property is Urban Land Complex, which was not evaluated in the survey, and therefore requires site specific evaluation to determine limitations for development.

Utilities

Airport utility systems, which were inventoried, included sanitary sewer, storm drainage, and water mains. Following is a brief description of each of these systems as they relate to Paine Field.

Sanitary Sewer. Paine Field was originally constructed as an Army Air Force Base and approximately five miles of the World War II era sanitary sewer collection system remains intact. Sewers range from 6 to 12 inches in diameter. The WWII era pipe is predominantly concrete with mortar joints, and relatively high levels of groundwater infiltration have been observed, typical for such pipe. Sewers constructed to serve new facilities are PVC with rubber ring joints and minimal infiltration. Hydraulic capacity of existing sewers is adequate. The airport has agreements with the Olympus Terrace Sewer District and the Mukilteo Water District for wholesale sewer service. Runway 16L/34R is the divide, with the Olympus Terrace Sewer District, receiving flow from the portion of the airport west of Runway 16L/34R and the Mukilteo Water District receiving flow from the Bomarc Business Park and other airport property east of Airport Road. Airport sewage connections to the Mukilteo Water District sewer are on 100th St. S.W. and 106th St. S.W. The City of Everett in turn provides sewage treatment for the Mukilteo Water District. Sewage is discharged to the Olympus Terrace Sewer District system at Manhole 9-3 on the west side of the airport.

Maintenance of the sewage collection system on airport property upstream of the sewage meter (located at Manhole 9-3) is currently the responsibility of Snohomish County. The airport has recently replaced a series of force mains in a multi-year program of deep gravity line sewer upgrade projects.

Storm Drainage. A Paine Field Storm and Sanitary Sewer Study identified airport stormwater runoff as tributary to four major drainage basins: the Japanese Gulch on the north, Big Gulch to the west, Swamp Creek to the south, and Lake Stickney to the east. A recent study on the Runway Safety Area (RSA) project also identified 22 acres within the Smuggles Gulch drainage basin.

The existing storm drainage system on Paine Field was developed in stages beginning in the 1940s when the field was first constructed. The 1981 Study indicated that "approximately 60,000 lineal feet of concrete and corrugated metal pipe, ranging in size from 6 to 24

inches" have been installed over the years, much of which were 30 to 40 years old in 1981. Since 1981, numerous modifications and additions have been made to improve the storm drainage system. The regional detention system for Japanese Gulch, Lake Stickney, and portions of the Big Gulch detention systems, has been constructed to reduce current and anticipated future impacts of airport development. The north/south trunk storm main to the Japanese Gulch regional detention system and the north/south trunk storm main to the Wetland #25 regional detention facilities both have been constructed increasing internal system capacity. Major improvements to the Big Gulch and Smuggles Gulch Basin Stormwater detention systems were recently constructed as part of the Runway 16R/34L safety area improvement project, including new wetland creation, bioswales, ponds, and control valves. As new tenant development has occurred, older undersized lines have been eliminated and newer system modifications have been added to include oil/water separation at tenant sites and system flow controls as necessary, to mitigate downstream capacity inadequacies.

Water Main System. Paine Field is served by the Mukilteo Water District. Master meters at the 100th and 112th St. entrances to the airport control the water supply. A 4.5 million gallon reservoir is located on the southern portion of airport property (between Goodrich Hangar 1 and Goodrich hangar 3). The normal operating level in the reservoir ranges between 109 feet and 90 feet, creating an average static system pressure of 39 pounds. The Water District Comprehensive Plan indicates the available fire flow at 4,000 gallons per minute. Goodrich Hangars 1 and 3 utilize the reservoir with the assistance of the company's fire pumps to provide the required 18,000 gallons per minute for the deluge system.

The manager of the water district describes the condition of the water as good. There are some pockets of old AC (asbestos cement) mains still in service, but they will be replaced in time. These old mains are primarily located on the southern end of airport property. New mains range in size to accommodate specific needs of airport tenant improvements.

Pavement Analysis

Utilizing available information, the strength of various aircraft operating surfaces at Paine Field have been estimated and are listed in the following table, entitled *AIRPORT PAVEMENT STRENGTHS*. Please refer to the previous illustration, entitled *EXISTING AIRPORT LAYOUT PLAN*, for a graphic depiction of the location of the various pavement areas.

Table A3
AIRPORT PAVEMENT STRENGTHS
Paine Field Master Plan Update

Pavement Feature	Wheel Configuration	Estimated Design Weight	Aircraft Type
Runway 16R/34L, [1]	Double Dual Tandem	830,000 lbs.	B-747
Taxiway A,	Dual Tridem	722,000 lbs.	B-777
and Runway 11, west of	Dual Tandem	345,000 lbs.	B-767
Taxiway A [2]	Dual	172,000 lbs.	B-737, B-727
Taxiway A-A	Double Dual Tandem	650,000 lbs.	B-747
	Dual Tandem	300,000 lbs.	B-767
	Dual	175,000 lbs.	B-737, B-727
Taxiway A-1 [4]	Double Dual Tandem	1,000,040 lbs.	B-747
	Dual Tridem	902,500 lbs.	B-777
	Dual Tandem	345,000 lbs.	B-767
	Dual	250,000 lbs.	B-737, B-727, B-757
Taxiway A-2 [3]	Single	30,000 lbs.	
Taxiway A-3 [2]	Dual	150,000 lbs.	B-727
Taxiway A-4 [2]	Dual	150,000 lbs.	B-727
Taxiway A-5 [2]	Dual	150,000 lbs.	B-727, B-737
Taxiway A-6 [2]	Double Dual Tandem	550,000 lbs.	B-747
	Dual Tandem	250,000 lbs.	B-767
	Dual	150,000 lbs.	B-737, B-727
Taxiway A-7 [3]	Double Dual Tandem	750,000 lbs.	B-747
	Dual Tridem	722,000 lbs.	B-777
	Dual Tandem	325,000 lbs.	B-767
	Dual	172,000 lbs.	B-737, B-727, B-757
Taxiway A-8 [3]	Double Dual Tandem	650,000 lbs.	B-747
	Dual Tandem	300,000 lbs.	B-767
	Dual	175,000 lbs.	B-737, B-727, B-757
Taxiway A-9 [3]	Double Dual Tandem	830,000 lbs.	B-747
	Dual Tridem	722,000 lbs.	B-777
	Dual Tandem	345,000 lbs.	B-767
	Dual	172,000 lbs.	B-727, B-737, B-757
Taxiway B [4]	Single	25,000 lbs.	
	Dual	35,000 lbs.	
Taxiway C to D-2 [2]	Dual	150,000 lbs.	B-727, B-737, B-757
Taxiway C Southeast of D-2 [4]	Single	12,500 lbs.	
Taxiway D to D-2 [2]	Single	12,500 lbs.	

Table A3 (continued)
AIRPORT PAVEMENT STRENGTHS
Paine Field Master Plan Update

Pavement Feature	Wheel Configuration	Estimated Design Weight	Aircraft Type
Taxiway D Southeast of D-2 [4]	Single	12,500 lbs.	
Taxiway D-1 [2]	Dual	150,000 lbs.	B-727, B-737, B-757
Taxiway D-2, D-3, and D-4 [4]	Single	12,500 lbs.	
Runway 11/29, east of Taxiway A [4]	Single Dual	40,000 to 50,000 lbs. 55,000 to 75,000 lbs.	
Taxiway W-1	Single	12,500 lbs.	
Taxiway E [2]	Double Dual Tandem Dual Tandem Dual	550,000 lbs. 250,000 lbs. 150,000 lbs.	B-747 B-767 B-737, B-727
Runway 16L/34R [3]	Single	12,500 lbs.	
Taxiways F & G [3]	Single	12,500 lbs.	
Taxiway H [4]	Dual	150,000 lbs.	
Taxiways K-5 & K-6 [4]	Single Dual	20,000 lbs. 35,000 lbs.	
Back Terminal Ramp Overlay [2]	Dual	150,000 lbs.	
Back Terminal Ramp Reconstruction [3]	Dual	150,000 lbs.	B-727, B-737, B-757
Inner Terminal Ramp Overlay [2]	Dual	150,000 lbs.	
Inner Terminal Ramp Reconstruction [3]	Dual	150,000 lbs.	B-727, B-737, B-757
Central Ramp and Jet Deck [4]	Single	12,500 lbs.	
Outer Terminal Ramp [4]	Single Dual	20,000 lbs. 35,000 lbs.	
Forest Service Ramp [4]	Single Dual	20,000 lbs. 35,000 lbs.	
West Ramp [4]	Single	12,500 lbs.	
East Ramp [3]	Single	12,500 lbs.	

1 Except the southernmost 1,300 feet of concrete, which has a B-747 capacity of 512,000 lbs.
2 Pavement strength estimate based on deflection testing and overlay design.
3 Pavement strength estimate based on pavement design.
4 Pavement strength estimate based on pavement cross section as indicated in available documentation and estimated average subgrade conditions.
Note: Pavement areas, which are available for use by large aircraft, are illustrated on operational chart, which is available from airport management.

Airspace, Navigation, and Communication Aids

Paine Field, as with all airports, functions within the local, regional, and national system of airports and airspace. The following illustration, entitled *AIRSPACE/NAVAIDS SUMMARY*, and narrative provide a brief description of Paine Field's role as an element within these systems.

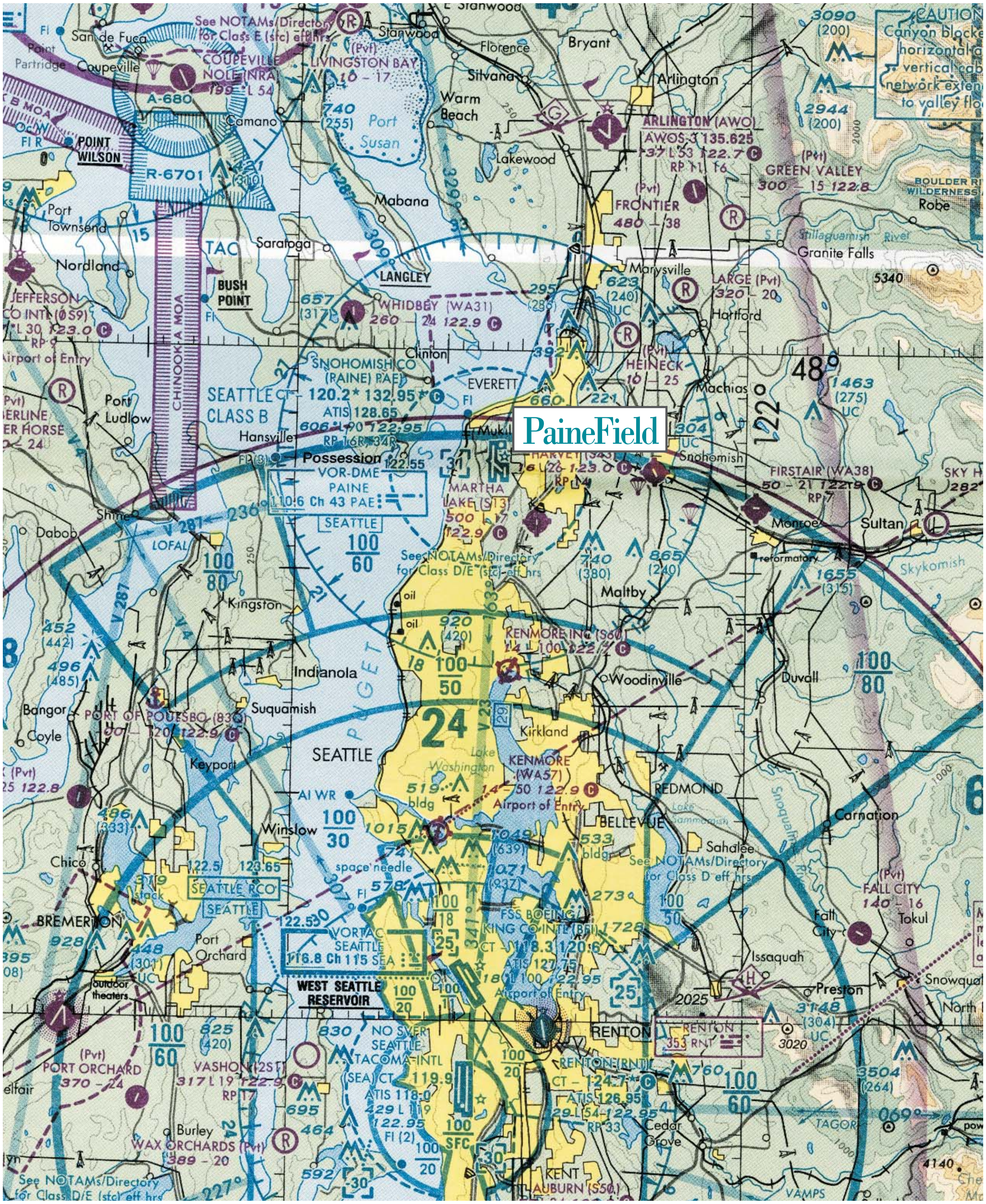
Air Traffic Service Areas and Aviation Communications

FAA air traffic controllers, stationed in Air Route Traffic Control Centers (ARTCC), provide positive air traffic control within defined geographic jurisdictions. There are some twenty-four geographic ARTCC jurisdictions established within the continental United States. Paine Field is contained within the Seattle ARTCC jurisdiction. The Seattle ARTCC includes the airspace in all of Washington State and portions of Oregon, California, Nevada, Idaho, and Montana.

Aviation communication facilities associated with the airport include the FAA Air Traffic Control Tower at Paine Field (frequency 132.95 on the west side of the airport; 120.2 on the east side of the airport) and an Aeronautical Advisory Station (UNICOM) on frequency 122.95. In addition, the airport has an Automatic Terminal Information Service (ATIS), frequency 128.65, and is served by the Flight Service Station (FSS), frequency 122.55, located in Seattle.

Airspace

Local airspace surrounding Paine Field is designated as Class D airspace. The configuration of each Class D airspace is tailored to the individual airport. Generally, Class D airspace consists of the immediate airspace within a horizontal radius of five statute miles from the geographic center of airports with control towers and extends from the surface up to, but not including, an altitude of 2,500 feet above ground level (AGL). The ceiling of the Class D airspace at Paine Field extends up to, but not including, 3,100 feet MSL. Class D airspace is in effect whenever the ATCT is operational, which at Paine Field is between 7:00 a.m. and 9:00 p.m. In order to operate on the airport or within Class D airspace, pilots must establish two-way radio communications with air traffic control personnel.



Approximate Scale 1"=7 Nautical Miles

Figure A9 **Airspace/NAVAIDS Summary**

Source: **Seattle Sectional Aeronautical Chart, 57th Edition, June 1999.**

MASTER PLAN UPDATE

PaineField Snohomish County Airport

The primary airspace influence in the vicinity of Paine Field is the Seattle Class B Airspace, which is irregularly shaped and extends in concentric circles around Seattle-Tacoma International Airport. The Seattle Class B Airspace consists of controlled airspace extending upward from various floor elevations to a ceiling of 10,000 feet AMSL, within which all aircraft are subject to specific operating rules (an ATC clearance must be obtained to enter the airspace), specified requirements on pilot qualification (a pilot must have a private pilot certificate or better), and aircraft equipment (a transponder with automatic altitude reporting and a two-way radio). Paine Field is located just within the 30-mile Class B airspace ring surrounding Seattle-Tacoma International Airport, in an area that has a floor elevation of 6,000' MSL.

International boundaries, military airports, military operations areas, and restricted areas can also impact airspace use in the vicinity of a civil airport. There is one military airport and two military operations/restricted areas located within a 30-nautical mile (NM) radius of Paine Field. Whidbey Island Naval Air Station (NAS) is located approximately 30 nautical miles (NM) northwest of Paine Field. There are two Military Operations Areas (MOA), Chinook A MOA and Chinook B MOA, one Restricted Area (RA), R-6701, and an Alert Area (A-680), associated with Whidbey NAS, which are located within the vicinity of Paine Field.

The Chinook A MOA is located 13 nautical miles (NM) west of the airport and the Chinook B MOA is located 24 nautical miles (NM) northwest of the airport. Both MOA's have an altitude of use between 300 and 5,000 feet MSL. Restricted area (R-6701) is located 15 NM northwest of the airport and has intermittent uses of altitude up to 5,000 feet MSL. Alert Area (A-680) is located 19 NM northwest of the airport, has an altitude use up to 3,000 feet MSL, and is used Monday through Friday, 1000 to 0130 hours April through October, and 1000 to 2359 hours November through March. Additionally, the boundary between the United States and Canada is located approximately 75 miles north of the airport; however, neither situation presents a significant airspace influence for aircraft operating into and out of Paine Field.

Navigational Aids

A variety of navigational facilities are currently available to pilots around Paine Field, whether located at the airport or at other locations in the region. Many of these navigational aids are available to enroute air traffic as well. In addition, there is a compliment of navigational aids (NAVAIDS) that allows a variety of instrument approaches to the airport.

Airport and regional navigational and landing aids available for Paine Field include an Instrument Landing System (ILS), with a Localizer (LOC) and Glide Slope (GS), Non-Directional Radio Beacon (NDB), and VHF Omnidirectional Range/Distance

Measuring Equipment (VOR/DME). In addition, Runway 16R/34L has a Global Positioning System (GPS), and as previously discussed, an ILS facility located on airport property that provides a straight-in instrument approach to Runway 16R.

The Paine (PAE) VOR/DME is located just northeast of the field on the adjacent Boeing Ramp and has a frequency of 110.60. Additional navigational aids within the vicinity of Paine Field include a VHF Omnidirectional Range (VOR) located at Seattle-Tacoma International Airport (frequency 116.80) and four NDBs. The NDBs include: Renton (353 RNT) located 26 nautical miles (NM) south, Kitsap (206 PWT) located 31.4 nautical miles (NM) southwest, Skagit/Bay View (240 BVS) located 34.1 nautical miles (NM) north, and Carney (274 CAN) located 37.4 nautical miles (NM) southwest of Paine Field.

Presently, there are four published instrument approach procedures at Paine Field. These are listed in the following table, entitled *INSTRUMENT APPROACH PROCEDURES*.

Table A4
INSTRUMENT APPROACH PROCEDURES
Paine Field Master Plan Update

Approach	Designated Runway(s)	Ceiling Minimum (AGL)	Visibility Minimums[1]
ILS	Runway 16R	200 Feet	½ Mile
NBD	Runway 16R	595 Feet	¾ Mile
GPS	Runway 16R	400 Feet	½ Mile
GPS	Runway 34L	421 Feet	¾ Mile
VOR or GPS-B	Circle to Land	454 Feet	1 Mile

Source: U.S. Terminal Procedures, Northwest (NW), Vol. 1of 1, 15 June 2000.
1 Depending on category of aircraft.

Seattle-Tacoma General Aviation Reliever Airports

As set forth in the Aviation Investment and Reform Act for the 21st Century (AIR 21), Paine Field is the only airport in the state of Washington designated as a general aviation "super reliever" airport. In addition to Paine Field, there are presently four other general aviation reliever airports designated for Seattle-Tacoma International Airport. These include: Auburn Municipal Airport, Auburn, Washington; Renton Municipal Airport, Renton, Washington; Harvey Field, Snohomish, Washington; and Boeing Field/King County International Airport, Seattle, Washington. Table A5, entitled *SEATTLE-*

TACOMA INTERNATIONAL AIRPORT AND GENERAL AVIATION RELIEVER AIRPORTS SUMMARY, provides a listing of selected information about the relationship of Paine Field to Seattle-Tacoma International Airport and the other general aviation reliever airports.

Table A5
SEATTLE-TACOMA INTERNATIONAL AIRPORT AND GENERAL AVIATION RELIEVER AIRPORTS SUMMARY
Paine Field Master Plan Update

Airport	Distance and Direction from Paine Field (NM)	Distance and Direction from Sea-Tac (NM)	Longest Runway Length (feet)	Elevation (AMSL)	Approaches
Paine Field	---	28 N	9,010	606	CAT I ILS, NDB, VOR-B, GPS
Seattle-Tacoma International	28 S	---	11,900	429	CAT I ILS, CAT II ILS, CAT III ILS, VOR, NDB, GPS
Auburn Municipal	35 S	7 SE	3,400	57	---
Renton Municipal	26 S	4 NE	5,379	29	NDB, GPS
Harvey Field	7 E	28 NE	2,600	16	---
Boeing Field	23 S	5 N	10,001	18	CAT I ILS, LOC/DME

Financial Inventory

The primary goal of this task is to gather materials that summarize the financial management of the airport. In addition, it is important to develop an understanding of the financial structure, constraints, requirements, and opportunities for airport activities as related to the development of a capital improvement program. The documents that have been gathered and reviewed for this financial inventory will be used to formulate a reasonable and financially sound Capital Improvement Program with which to fund projects identified in the master planning process.

With this goal in mind, the airport's financial statements have been gathered for fiscal years 1996 through 2000. In addition, Federal and State capital improvement grant information has been compiled, including current funding policies and a historical review of previous grants received. The airport's current five-year Capital Improvement Program has also been received and reviewed.

The review of the financial documentation for Paine Field indicates that the airport is operationally self-supporting. The airport is operated as an enterprise department, with its income and expenses held separately from other Snohomish County funds. As identified in the 2000 income and expenses report, major sources of revenue for the airport include: airport fees, commercial leases, hangars and tie-downs, utility fees, and fuel fees. Major expenditures include: salaries and wages, personnel benefits, professional services, utilities, supplies, and repair and maintenance.

Some of the improvements indicated in the current five-year Capital Improvement Program (CIP) for the airport include: building purchases and repairs, airfield repair, general aviation ramp repairs, crash and rescue truck replacement, ARFF facility replacement, equipment, hangars, new building construction, north complex road access, obstruction removal, outer ramp addition, safety area project, perimeter fencing, main runway sweeper, and terminal remodel.

Table A6
REVENUE AND EXPENSE SUMMARY, 1996-2000
Paine Field Master Plan Update

Year	Revenues	Expenses	Net Income (Loss) [1]
1996	$5,545,000.00	$4,347,000.00	$1,198,000.00
1997	$6,025,000.00	$4,921,000.00	$1,104,000.00
1998	$6,435,000.00	$5,230,000.00	$1,205,000.00
1999	$6,671,000.00	$5,291,000.00	$1,380,000.00
2000	$7,314,572.00	$6,493,106.00	$821,466.00

Source: Paine Field Financial Reports
[1] Actual. Not including depreciation of capital assets.

Community Involvement

As a vital component of this Paine Field Master Plan Update, a public information/ involvement program has been initiated. The goals of this public involvement program include:

- Create public awareness of the Paine Field Master Plan Update.
- To involve the public in the identification of the changes to be made to the Master Plan Update and to seek public input on the direction for Paine Field.
- To gain public understanding, acceptance, and support for the Master Plan Update.

An Advisory Committee of 25 interested parties to review the development of the Paine Field Master Plan Update was established. Membership of the Paine Field Master Plan Update Study Advisory Committee (Advisory Committee) reflects the broad spectrum of people, interests, and distinct communities in the Paine Field area. The purpose of the Advisory Committee is to provide a broad and balanced range of perspectives on the update of the planning documents, which will guide future development at the airport. The Advisory Committee provides a forum for open dialogue in which to express the broad range of interests and points of view; challenge the study assumptions; evaluate alternatives; help identify impacts and trade-offs of choices; and provide a base for reality testing of proposed solutions.

The Advisory Committee will meet to review and discuss issues and material prior to the key planning and/or decision points. It will assist the County and Consultant Team by providing review and comment on study elements including the purpose of the plan, the development of alternatives, the identification of issues, impact and trade-offs of choices, and the evaluation of alternatives and plan recommendations as they emerge.

Issues Inventory

Identification of the current and future development issues, which may impact the use of a public facility, is an important step in any planning process. This is particularly true of an airport where the infrastructure investment is great, where the issues are complex, and where the entire airport facility, along with its environs, should be planned in unison to avoid incompatibility between the airport and its surroundings. The following narrative identifies present and future development issues that will be confronted at Paine Field. Some of these issues have been gleaned from interviews in the 1992-1995 Master Plan and Noise Study Update, some from specific information gathered during the inventory process, while others relate to general airport planning principles. The intent of this update is to evaluate these and perhaps other issues, and incorporate these concerns into the formulation of the plan and program needed for Paine Field.

Opening Paine Field to Commercial Service

Historically, Paine Field's role has been to only accommodate general aviation and military activity on a regular basis (although San Juan Airlines did provide commercial passenger service at the airport in 1987 and 1988, and Horizon airlines considered starting service to Portland in 1998). The broad issue of Paine Field's role is a key concern of all groups interested in planning for the future of the airport. It is a question that has important regional and local implications. Some concerns about the role of Paine Field are listed below:

- The FAA would like to be assured that Paine Field fulfills the role required to meet regional and national aviation demands and that funds furnished to Paine Field, both in the past and in the future, are wisely spent.

- User groups are interested in having necessary aviation facilities to meet their needs in the context of the demands being placed on the airport.

- Community groups are interested in the impact of the airport on quality of life issues, along with commerce and economic considerations.

Environs Land Use/Aircraft Generated Noise

The operation and development of an airport affects more than just airport property. Airport planning cannot stop at the boundary of the airport but must consider off-airport effects with any airport development proposal. The FAA approved an FAR Part 150 Noise Compatibility Plan for Paine Field in 1995. The current study will produce existing and twenty-year future noise contours, but will not update the Part 150 Noise Compatibility Plan. The major off-airport issue is noise relating to the landing and takeoff of aircraft along with aircraft ground operations. Some specific concerns include:

- West side noise, noise buffer, trees, and terrain.
- Noise impacts and residential development.
- Noise impacts and noise sensitive land uses such as schools, health care facilities, etc.
- Noise mitigation for future commercial/industrial expansion.

Surface Transportation

Probably no other segment of Snohomish County's transportation system has been studied as thoroughly in recent years as the area around Paine Field. The Draft and Final EIS for the expansion of the Boeing Everett facility included extensive and thorough analysis of both existing conditions and future system requirements for the roadway system in the vicinity of Paine Field. With many improvements recently underway and completed, the

major requirements for additional transportation planning analysis as a component of the Paine Field Master Plan Update will be closely tied to the types of future development envisioned. In addition, the continued integration of the surface transportation system with airport facilities is an important planning function. Specific concerns include:

- Coordination with the Regional Transit Plan.
- Impact on other transportation systems; e.g., the school bus transportation system.
- The surface transportation network and how it will affect the surrounding areas.
- Impact on the ability of Boeing and B.F. Goodrich employees to travel to and from place of employment.
- Traffic mitigation on future industrial expansion.

Safety

This issue has two components; the first relates to the protection of a safe aviation operating environment on and around Paine Field; the second relates to the safety of surrounding land uses in relation to aircraft operations at the airport.

- Identification and resolution of any existing or potential obstruction or safety encroachments.
- Safety for schools and other surrounding land uses.

Environmental Issues and Impacts

It is important that the master plan update adequately address the environmental impact of any proposed development. Specific concerns, which have been mentioned in relation to Paine Field, include:

- Wetlands and drainage issues.
- Water quality issues.
- Impacts on fish and wildlife habitat.
- Air quality issues.

Economic Impacts and Growth Management

An airport is an important element of the regional transportation infrastructure, just like highways, rail, and even communication networks. Because of this, an airport can be important in influencing the nature of growth in the region. The development of the airport must be evaluated in light of its own potential to influence activity, its potential to achieve a broader set of public objectives, and perhaps its ability to forestall undesirable effects. Specific concerns at Paine Field include:

- Economic impact: Look at both effects of doing and not doing something.
- Economic development should be self supporting.
- Continued economic viability of existing businesses at Paine Field such as Boeing.
- Paine Field's continued contribution to the economic vitality of Snohomish County.
- Community objections to air carrier use of Paine Field.
- Impact on property values.
- Airport is a community resource and positive contributor to employment in community.

Airport Development

From the standpoint of traditional planning roles, the identification of how the airport should physically develop is a very important issue for the Paine Field Master Plan Update. An airport facility must be developed with the capacity to accommodate expected demand related to aviation activity, industrial growth, ground access, etc. Specific issues at Paine field include:

- The development potential of the west side of the airport.
- Topographic and wetland considerations related to the west side development.
- The additional aviation development area, which would be realized if Runway 11/29 were closed. The effect of closing Runway 11/29 on the operational characteristics of the airport.
- The efficient and effective use of existing developable areas.
- The proposal to establish a Museum of Flight/Aircraft Restoration Facility on Paine Field.
- The proposal to develop a multi-use site at the NW corner of the airport to potentially house the museum of flight, an aviation tour center, a restaurant, and a hotel with meeting facilities.

The above mentioned development issues are certainly not all of those which will impact the future of Paine Field. However, these are the principal issues which the airport will face in the near future and which also will shape the content of this planning study.

Summary

The goal of this chapter is to provide general background information pertaining to the airport, its aviation operating environment, its physical surroundings, and its financial situation. The *Inventory* chapter is vital from the standpoint that it will be used as a reference in the analysis and design process that is required to prepare the Airport's future development plan.

The next step in the planning process is to formulate forecasts for the quantity and type of future aviation activity expected to occur at the airport during the forthcoming twenty years.

Forecasts of Aviation Activity

Introduction

This is the second chapter in the Master Plan Update document. The first chapter identified the existing airport facilities, as well as physical conditions on and surrounding the airport. The next step in the process of planning for an airport facility is to determine the need for new or expanded facilities, which is to be reasonably expected over the specified planning period. At Paine Field, this involves the development of a set of forecasts that defines potential future aviation demand. As in most airport planning studies, forecasts are based on "unconstrained demand" (market demand) derived in part from actual and forecast population data, along with other factors. At this early stage in the planning process, it is necessary to utilize this theoretical "unconstrained demand" in order to provide a basis for developing various operational demand scenarios, without regard to site specific physical or environmental constraints; the identification and analysis of facility options for various operational demand scenarios then follows. Various alternatives can subsequently be developed to accommodate these facility options. Recognizing the myriad of constraints that will influence these alternatives, Snohomish County will be provided with a rational basis to select the appropriate alternative for airport development. Conditions on the airport and in the area surrounding the airport will influence the type and volume of aviation activity which can be reasonably accommodated.

Aviation activity forecasting generally commences by utilizing the present time as an initial point, supplemented with historical trends obtained from previous year's activity and recorded information. This data has evolved from a comprehensive examination of historical airport records from airport personnel and a review of the following documents, *Paine Field Airport Master Plan and Noise Study Update (1995), Puget Sound Regional Council: Regional Airport System Plan (1999), FAA Terminal Area Forecasts (1990-2015),* and the *FAA Aviation Forecasts Fiscal Years 2000-2011.* These documents were prepared in different years, making the base year data quite variable, and emphasizing the

need for establishing a well-defined and well-documented set of base information from which to project future aviation activity trends.

Prior to an examination of current and future activity levels at the airport, there are several conditions and assumptions that should be noted, which form the basis or foundation for the development of the forecasts contained herein. The following statements cover a wide variety of physical, operational, and socioeconomic considerations, and include, although not necessarily in order of importance or priority:

- **Weather Conditions.** Existing weather data (i.e., visibility, ceiling and wind conditions) for Paine Field were available for analysis from the National Oceanic and Atmospheric Administration (NOAA). With the exception of very few days annually, the airport is not adversely affected by poor weather conditions. Visual Flight Rules (VFR) meteorological conditions are experienced approximately 89.1% of the time annually; therefore, aircraft can operate at the airport on a regular basis throughout the year, with limited interruption due to weather. The potential negative impact of poor weather conditions on the operational capability of the airport is documented in the next chapter of this document. This information will be analyzed and evaluated in later chapters regarding the identification of potential instrument approach facility enhancements and the preparation of development alternatives for their implementation.

- **Airport/Community Location and Proximity.** Paine Field is situated six miles southwest of the Everett Central Business District (CBD) and twenty miles north of downtown Seattle. Breathtaking views of the Cascade Mountain Range to the east and the Olympic Mountain Range to the west help to define the bucolic setting and popularity of Paine Field with many aviators across the country, as well as with surrounding neighboring residents. The airport serves as an economic magnet to the region of the state, supporting approximately 30,000 jobs. Vehicular access to the airport is provided by Interstate 5 (I-5), State Road 99 (SR 99), State Road 526 (SR 526/Boeing Freeway), State Road 525 (SR 525/Mukilteo Speedway) and existing roads - Airport Road and128th St. S.W. , which link the airport to both, I-5 and SR 99.

- **Regional Socioeconomic Conditions.** The existing socioeconomic condition of a particular region has historically impacted aviation activity within that area. The two primary socioeconomic indicators, which are often analyzed in the forecast of aviation activity, are population and employment statistics. According to the latest population data prepared by the Washington State Office of Financial Management (OFM), the estimated population in 2000 for the City of Everett totaled 95,000 residents. This compares to the 1990 population for Everett of 69,961, an increase of 35.8%. The year 2010 (the most current data available) population projections

for Everett are expected to reach a total of 125,000, reflecting an average annual growth rate of 2.5%. This compares to a projected average annual growth of 1.6% for Snohomish County, 1.0% for the Puget Sound Region, and 1.2% for the State of Washington. The OFM estimates that employment for Snohomish County and the State of Washington for the year 1999 is 213,600 and 3.1 million respectively. Employment is projected to increase to 303,405 and 3.97 million, representing a respective 1.7% and 1.2% average annual growth rate. In addition, as referenced by the OFM and PSRC, estimated per capita income in 1998 for Snohomish County was $27,015, for the State of Washington was $28,719, and for the United States was $27,203. Per capita income for the State of Washington is projected to be $34,458, a 33.9% increase, and for the United States it is projected to be $32,857, a 36.8% increase. Per capita income is currently unavailable for Snohomish County.

- **Community Support.** Paine Field generally benefits from the support of the surrounding cities and county governments, as well as local industry and residents. The airport is recognized as a vital county asset, which contributes to the stability and the future of the area's economy. The support for the airport is tempered over the concern of aircraft noise from both the residents near the airport and the representatives they elect. The overall position of the county is one of continued growth and development, with special focus on the impetus that the airport provides to maintain and attract additional economic and aviation-related development to the region.

  It should be noted that Snohomish County adopted a "General Aviation" role for Paine Field in a Mediated Role Determination process in 1978/79, which will continue to affect the accommodation of various aviation activities at the airport. This General Aviation roles objective is to retain and enhance light aircraft general aviation as the dominant aeronautical activity at Paine Field while encouraging the continuation and expansion of aircraft related industries, business and corporate aviation, public service aviation, air taxi and commuter service, and discouraging expansion beyond 1978 levels of supplemental/charter air passenger service (per 14 CFR Part 121 SFAR 38-2 pp6), large transport crew training operations, air cargo and military aviation, while remaining compliant with the covenants in deeds and grants of the United States government.

  Additionally, many of the surrounding county communities and much of the Puget Sound region benefit from the close proximity of a regional general/industrial aviation facility and, in turn, provide an economic base that can attract additional based aircraft, as well as industrial/business development to the airport.

- **Facilities Potential.** Paine Field currently serves a vital service role to the economy of western Washington. It is one of several airport facilities within the regional

service area with adequate runway length to accommodate the operation of air carrier aircraft. In addition, the airport can accommodate the operation of large business jet aircraft, which need runway lengths greater than available at many of the region's other general aviation airports.

- **Negative or Neutral Factors.** As a general comment, the airport has very few negative factors and is in an enviable position due to its many positive features and conditions. However, there are some factors that can and do have a negative impact on the airport and that must be considered in the planning process. The first issue is the overall condition of the general aviation industry in the United States, which, since 1978, had been in a significant recession until the mid 1990s. The FAA has identified several factors that have contributed to this prolonged downturn. These include three economic recessions, two fuel crises, the enactment of the Airline Deregulation Act of 1978, the repeal of the GI Bill, and the repeal of the investment tax credit. Secondly, due to the substantial areas of owner occupied single family residential development around the airport, airport expansion is constrained from both a physical and operational standpoint.

  However, there are a number of bright spots having a positive impact in certain segments of the general aviation industry. They include the passage of the long-awaited General Aviation Revitalization Act of 1994, which provides an eighteen-year limit on product liability lawsuits against general aviation aircraft and component manufacturers. As a result of this legislation, there is renewed interest and optimism among US aircraft manufacturers, who are either re-entering the single engine aircraft market after several years absence, or are increasing future production schedules to meet expected renewed demand. The growth in the amateur-built aircraft market, and the strength of the used aircraft market, indicate that demand for inexpensive personal aircraft is increasing. Increased general aviation instrument operations at FAA towered airports, and general aviation aircraft handled at FAA en route centers point to continued growth of users of more sophisticated general aviation aircraft. Additionally, operations at non-towered US airports have increased, supporting the belief held by many that much of general aviation has been forced out of many towered airports because of the increased commercial air carrier activity.

Historical Airport Activity

A tabulation of Paine Field's historical aviation activity since 1990 is presented in Table B1, entitled *HISTORICAL AVIATION ACTIVITY, 1990-2000.* This table presents the number of passenger enplanements and four categories of operations, plus total operations. **Local FAA Air Traffic Control personnel tabulate aircraft activity data during the time the tower is operational, currently 7 a.m. to 9 p.m. Operations occurring between 9 p.m. and 7 a.m. are not included, and are assumed to add approximately 5%. Forecast information is intended to reflect operations occurring during the time the tower is operational (from 7 a.m. to 9 p.m.).**

Table B1
HISTORICAL AVIATION ACTIVITY, 1990-2000
Paine Field Master Plan Update

Year	Passenger Enplanements[1]	Large Transport Aircraft Operations	Air Taxi Operations	General Aviation Operations	Military Operations	Total Operations	Instrument Operations[2]
1990	88	3,623	1,392	144,943	5,586	155,544	21,840
1991	314	3,308	1,516	152,330	5,929	163,083	22,016
1992	8	3,096	1,416	167,605	5,893	178,010	18,592
1993	155	2,837	1,464	187,215	5,307	196,823	21,092
1994	80	2,860	1,327	184,639	5,844	194,670	20,876
1995	0	3,653	2,070	153,584	5,426	164,824	20,679
1996	65	3,322	3,282	148,308	4,164	159,076	18,436
1997	209	3,679	2,884	174,891	1,911	183,365	19,827
1998	26	3,987	3,508	183,543	1,574	192,612	28,882
1999	0	4,011	4,131	194,801	2,464	205,407	32,187
2000	0	3,443	3,886	203,925	2,037	213,291	23,256

Source: Operations information provided by airport staff.
[1] FAA Terminal Area Forecast Report.
[2] Instrument Operations are not an additive element with regard to total operations.

- *Passenger Enplanements.* The passenger enplanements listed in the previous table are only those which occurred on military and charter flights. There is currently no scheduled airline passenger service provided to Paine Field.

- *Large Transport Aircraft Operations.* As counted by airport traffic control tower (ATCT) personnel in recent years, operations in this category (classified as Air Carrier by ATCT) include all aircraft capable of carrying over sixty passengers, including those aircraft used for cargo purposes, such as wide-body aircraft utilized by UPS, and using a three letter company designator (regardless of whether or not they actually are being utilized for passenger service). For the most part, these are made up of aircraft operating into or out of The Boeing Company or Goodrich.

- *Air Taxi Operations.* Operations in this class are made up of aircraft capable of seating less than 60 passengers, which are being utilized for passenger or air freight service and which use a three letter company designator or "Tango" (this is a definition used by ATCT personnel to classify aircraft operations. For planning purposes, air taxi operations will be included as part of the general aviation forecasts. Please refer to the Appendix for data from the Save Our Communities organization regarding the various possible definitions of air taxi, commuter, and regional airlines). At Paine Field, this category of operations is primarily made up of air freight operations with some non-scheduled passenger aircraft operations. As previously noted, there is currently no scheduled passenger airline service at Paine Field. However, in 1997, Horizon Airlines evaluated initiating service between Paine Field and Portland, OR with the thirty-seven seat DHC8-200 aircraft. Horizon ultimately decided to meet the projected growth in this market by increasing the size of their aircraft on the Seattle-Portland route from the DHC8 -200 to the seventy seat DHC8Q-400 and the fifty seat Canadair Regional Jet (CRJ200).

- *General Aviation Operations.* Historically, the number of general aviation operations has been directly tied to economic conditions. Nationally, there was an upward trend in the number of general aviation operations during the 1990s. This was due primarily to the great economic condition experienced for a majority of the country and a decrease in the price of fuel. These national trends are reflected at Paine Field during the last four years, where the number of general aviation operations has increased. This reflects the strength of the local/regional economy and the strength of the demand for general aviation facilities in the Seattle Metropolitan area.

- *Instrument Operations.* Instrument operations have remained relatively flat through the 1990s, with a slight increase in the last few years. Instrument aircraft

operations are those operations conducted by aircraft filing an IFR flight plan operating in the vicinity of Paine Field.

- *Military Operations.* The number of military operations at the airport has declined since the last Master Plan. The U.S. Army Aviation Support Facility located on Paine Field was responsible for a majority of the operations. However, in September 1996, this squadron relocated from Paine Field to Fort Lewis reducing the number of military operations conducted at the airport. Currently, the primary military use is related to C-9 and C-12 aircraft, supporting the Everett based aircraft carrier – U.S.S Lincoln, which regularly visit the field picking up or delivering sailors and their equipment, as well as EA-6Bs stationed at Whidbey Island Naval Air Station (NAS). It is projected that the demand for military operational activity at the airport will remain at this present level through the planning period.

Unconstrained Passenger Enplanement Demand Forecast

The projection of demand for passenger service; i.e., enplaned or boarding passengers at an airport, is an important part of the forecasting effort. In essence, passenger service projections form the cornerstone for formulating projections of air carrier/commuter aircraft operations. This task is more difficult at Paine Field because there is little history of passenger service on which to build a forecast. However, because of the population located in the vicinity of the airport, the driving time to Seattle-Tacoma International Airport (SEA-TAC), and the forecast population growth of the region, it can be reasonably assumed that some level of unconstrained demand exists for passenger service at Paine Field.

Passenger Service Demand Forecast Methodology

The methodology used to determine demand for passenger service at Paine Field involved determining an existing *domestic originating passenger to population* (PAX^{do}/POP) ratio for Seattle-Tacoma International Airport, then relating that ratio to the various population levels likely to be served by Paine Field if passenger service were available. Because of the existence of the most accurate and consistent population data and operational data for SEA-TAC, calendar year 1999 was chosen as the base year for determining the PAX^{do}/POP ratio. For this calculation, the area considered as the service area for SEA-TAC was a ten-county area in northwest Washington, consisting of Snohomish, King, Pierce, Skagit, Thurston, Grays Harbor, Mason, Kitsap, Island, and Lewis counties (this service area is consistent with the "market-shed" served by SEA-TAC as defined in the *Flight Plan Project* published in 1992 by the Puget Sound Air

Transportation Committee, with the exception that Whatcom County was included in the *Flight Plan Project*).

Through the 1990s, SEA-TAC experienced tremendous growth in terms of both passenger and cargo levels. Annual operations have increased from 355,077 in 1990 to 433,660 in 1999, representing a twenty-two percent increase. Additionally, passenger levels (domestic and international) increased seventy-five percent through these same years. In addition to a robust 16.4% growth in population within the SEA-TAC service area during the 1990s, the PAX^{do}/POP (8,608,553 enplanements/3,739,722 population) ratio for SEA-TAC increased to 2.30 in 1999 (2.30 domestic originating passengers annually for each person living within the defined service area). This is higher than the ratio used in the 1995 *Master Plan (MP)*, which was based on the PAX^{do}/POP (4,895,840 enplanements/3,211,757 population) ratio of 1.52 experienced at SEA-TAC in 1990. If only regional destinations, those within the 500-mile circle are considered (e.g., Bellingham, Vancouver, B.C., Port Angeles, Portland, Missoula, Butte, Kalispell, Helena, Yakima, Spokane, Pasco, Eugene, Boise, Pullman, and Sun Valley), the 1999 PAX^{do}/POP ratio is 0.22 (828,160 enplanements/3,739,722 population). This is an increase from SEA-TAC's 1990 regional PAX^{do}/POP ratio of 0.17 (538,865 enplanements/3,211,757 population) as used in the 1995 MP.

With these ratios as a basis, four scenarios for unconstrained enplanement demand at Paine Field were formulated. This methodology uses the PAX^{do}/POP ratio and census tract or county population projections for the defined service areas to determine enplanement demand forecasts. Snohomish County, the U.S. Census Bureau, and the Puget Sound Regional Council provided census tract population projections. In addition, estimated 1999 census information and population projections from the U.S. Census Bureau were utilized for all counties within the service area. The population projections provided by these entities are estimated to the year 2020. Because the forecasts are a twenty-year time frame, a trend projection based on historical data was used to determine the year 2021 population. In all scenarios, the PAX^{do}/POP ratios remain the same throughout the forecasting period.

1. *National Service Low Range.* This scenario considers the provision of passenger service at Paine Field with both national and regional destinations available (similar to the domestic service destinations presently served by aircraft operating at SEA-TAC). In this scenario, it is projected that passengers will only be captured from a service area within a thirty minute drive time of Paine Field (a map estimating the thirty minute driving distance from the airport was provided by the Snohomish County Public Works Department). The time of day for the model was based on the p.m. peak time frame of 4:30 p.m. to 5:30 p.m., which is consistent with the modeling approach used in the 1995 MP. The area is illustrated in the following figure, entitled *PAINE FIELD SERVICE AREA - THIRTY MINUTE DRIVE TIME*. It is realized that passengers are likely to be captured

from beyond the thirty minute area; however, this relatively small area was utilized to represent the minimum area from which Paine Field might attract passengers. As can be noted in the following table, entitled *UNCONSTRAINED ENPLANEMENT DEMAND FORECAST, 2001-2021*, the national low forecast indicates a passenger demand of 769,646 in 2001 increasing to 996,180 by the year 2021. This compares with the 1995 MP forecast demand of 553,000 in 2014 (the last year provided in that planning study). The increased demand over that projected in the 1995 MP is due primarily to a higher PAX^{do}/POP ratio and to a lesser extent, due to the population increase within the low range service area.

2. *National Service High Range.* This scenario considers the same national service defined above, with a larger service area. The service area for the high range scenarios is increased to include all of Snohomish, Skagit and Island counties, in addition to those portions of King county within a thirty minute drive of Paine Field. Passenger demand for this scenario is 1,137,263 in 2001 and is forecast to increase to 1,562,219 by 2021. The 1995 MP forecast demand was 895,000 by the year 2014. As stated above, this increase is primarily due to a higher PAX^{do}/POP ratio.

3. *Regional Service Low Range.* This scenario considers the same service area as Scenario 1 (thirty minute drive time) with the provision of only regional passenger service. For the most part, regional service is defined as providing service only to destinations within 500 miles (e.g., Bellingham, Vancouver, B.C., Port Angeles, Portland, Missoula, Butte, Kalispell, Helena, Yakima, Spokane, Pasco, Eugene, Boise, Pullman, Kelowna, Victoria, and Sun Valley), on aircraft seating less than 60 passengers (e.g., DHC-6, DHC-7, DHC8-200/300, EMB-120, Fokker F-27, etc.), although regional jets (EMB-135/145, CRJ-200, BAe-146, Fokker F-28, and larger turboprops such as the DHC8Q-400) are now being utilized in the United States (including SEA-TAC). This is consistent with the regional service type of aircraft and destinations presently operating at SEA-TAC. This scenario postulates a passenger demand of 117,929 and is forecast to increase to 152,640 by 2021. This compares with the 1995 MP of 96,000 by the year 2014. The increased demand is primarily due to a larger service area within the thirty minute drive area.

4. *Regional Service High Range.* As with the preceding scenario, only regional service is considered; however, the service area is increased to include all of Snohomish, Skagit and Island counties, in addition to those portions of King county within a thirty minute drive of Paine Field. This scenario estimates a passenger demand of 174,257 in 2001, increasing to 239,371 by the year 2021. This compares with the 1995 MP forecast of 155,000 by the year 2014. Again, this increase is due to a higher PAX^{do}/POP ratio and a larger thirty minute drive time area.

Although these forecasts are considered to be unconstrained, one long-term constraint has been factored in. If Paine Field provides commercial passenger service, this service would supplement that which is currently provided at SEA-TAC. The type of services offered at "supplemental" airports is an important consideration in determining the number of enplaned passengers that will be captured in a certain market. Passengers will tend to choose the airport with the most convenient schedule, widest range of destinations and lowest price combination, even if there is a longer ground trip required to get to the airport. The best selection of airline schedules for longer stage length trips and those to very small regional markets will only be available at the region's primary airport (SEA-TAC). Therefore, it is estimated that passenger demand at Paine Field would consist of no more than 50% of the medium- to long-haul stage length domestic market (trips of over 500 miles), and only 85% of the short-haul regional market. This assumption is consistent with assumptions made in *Flight Plan* during the forecasting process for that project and has been confirmed (to the degree possible) with passenger data available from SEA-TAC.

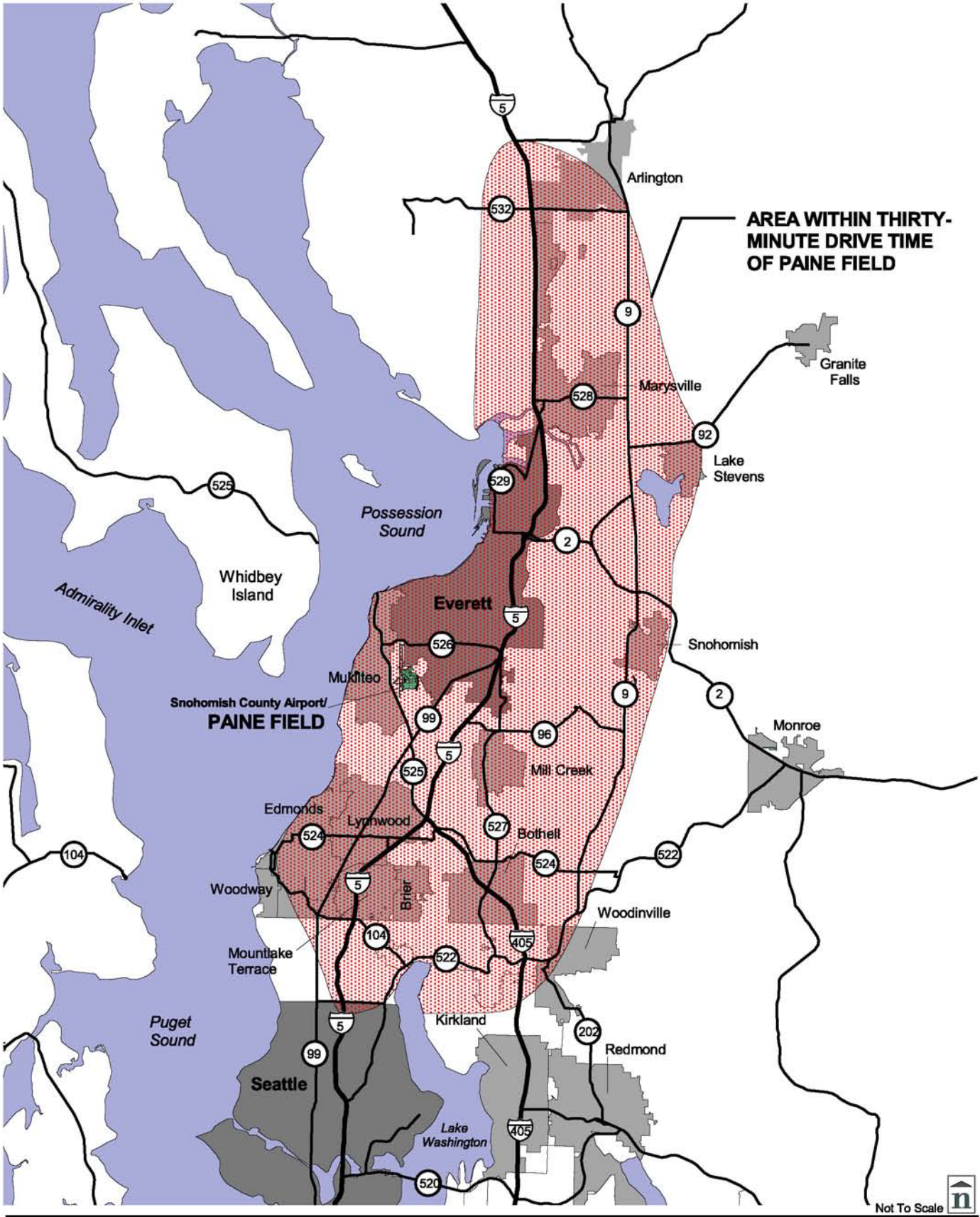


Figure B1 **Paine Field Service Area - Thirty-Minute Drive Time**

The unconstrained forecasts do not consider what happens in a new market. In other words, the forecasts do not consider the fact that when a new service is offered it will take some time for that market to mature and reach its full potential. The forecasts are only intended as a measure of demand within the market area.

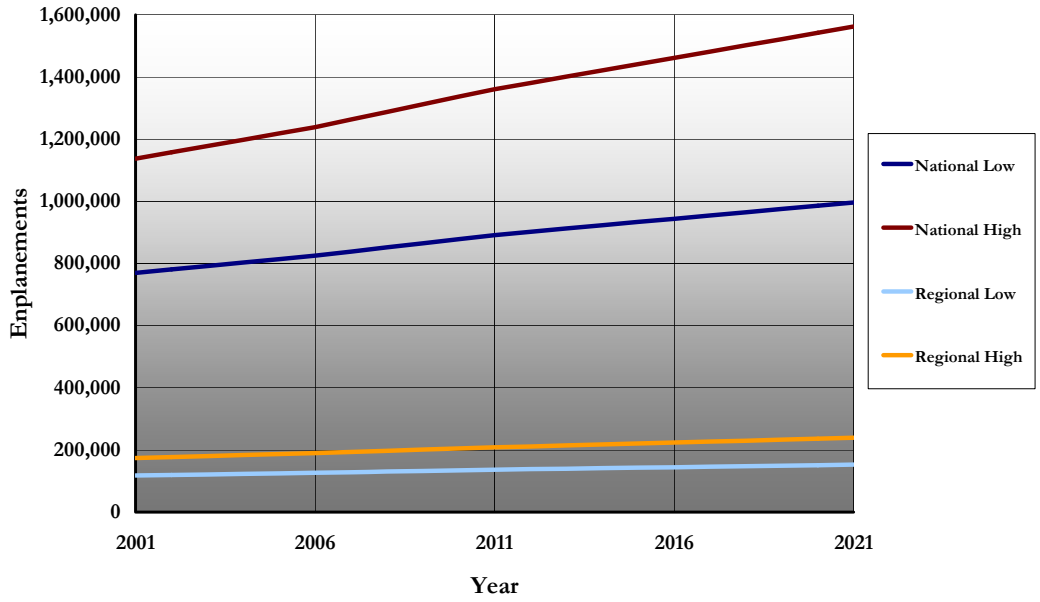
Enplanement forecasts are presented in the following table, entitled *UNCONSTRAINED ENPLANEMENT DEMAND FORECAST, 2001-2021*. The columns include data from: *Flight Plan* (Puget Sound Air Transportation Committee, 1992) and four scenarios for enplanement projections. A graphic presentation of the enplanement demand forecast is provided in the following figure, entitled *UNCONSTRAINED ENPLANEMENT DEMAND FORECAST SCENARIOS*.

Table B2
UNCONSTRAINED ENPLANEMENT DEMAND FORECAST, 2001-2021
Paine Field Master Plan Update

Year	Flight Plan	Scenario 1 National Service Low Range	Scenario 2 National Service High Range	Scenario 3 Regional Service Low Range	Scenario 4 Regional Service High Range
2001	---	769,646	1,137,263	117,929	174,257
2002	---	780,736	1,157,593	119,628	177,372
2003	---	791,826	1,177,922	121,328	180,487
2004	1,070,000	802,916	1,198,252	123,027	183,602
2005	---	814,006	1,218,581	124,726	186,717
2006	---	825,096	1,238,910	126,425	189,832
2009	1,220,000	865,019	1,312,096	132,543	201,046
2011	---	891,634	1,360,887	136,621	208,522
2014	1,430,000	922,998	1,421,287	141,426	217,777
2016	---	943,907	1,461,553	144,630	223,946
2021	---	996,180	1,562,219	152,640	239,371

Flight Plan	Interpolated from Alternate #14, The Flight Plan Project, Draft Final Report and Final Environmental Impact Statement, 1992, Puget Sound Regional Council.
National Service	Forecast with Airport served by national and regional air carriers.
Regional Service	Forecast with Airport served by regional air carriers only.
Low Range	Enplanements captured only from area within 30 minute drive time.
High Range	Enplanements captured from area within 30 minute drive time and from all of Snohomish, Skagit and Island counties.

Figure B2
UNCONSTRAINED ENPLANEMENT DEMAND FORECAST SCENARIOS
Paine Field Master Plan Update



Unconstrained Air Carrier/Commuter Operations Demand Forecast

The next step in the forecasting process is to project the demand for Air Carrier/ Commuter aircraft operations, using the forecast of enplanements as a basis. This process normally involves the evaluation of the type of passenger aircraft that have served the airport in the past and a projection of the type that will serve the airport in the future. With the type of passenger aircraft known, average seating capacity and load factors can be formulated, which then can be equated to a quantity of aircraft operations that will be needed to accommodate forecast enplanement demand.

While the trend of commuter airlines is leaning towards the use of larger regional jets (50-70 seats) and turboprops, it is not necessarily the case that all regional carriers will provide service with larger aircraft. From an operational standpoint, Paine Field's

market size may not necessitate the use of the larger 70-seat aircraft. As a result of contract negotiations with pilot unions, most airlines have adopted a "pilot contract agreement", precluding pilots of regional carriers from operating aircraft with more than 60 seats. As more and more airlines strive for higher load factors and more profitability, it is inevitable that a certain number of existing and/or newly implemented routes will be relinquished to regional carriers. This pilot contract agreement is not necessarily an issue for Horizon Airlines, which has ordered fourteen 70-seat Canadair CRJ-700s and fifteen 70-seat DeHavilland DHC8Q-400 turboprop aircraft.

Because the airport has no scheduled passenger service at this time, historic data on aircraft type and seating capacity cannot be used as a basis for future projections; therefore, assumptions regarding national trends as identified in *FAA Aviation Forecasts Fiscal Years 2000-2011* have been utilized as the foundation on which to build the forecast of Air Carrier/Commuter aircraft operations. Per the *FAA Aviation Forecast Fiscal Years 2000-2011,* and for purposes of this forecast documentation, Air Carrier is defined as an airline providing scheduled passenger service with aircraft larger than 60 seats, and Commuter/Regional is being defined as an airline primarily providing scheduled passenger service with aircraft a maximum of 60 seats. This is also consistent with current FAA Air Traffic counting criteria (air carrier vs. air taxi). Please refer to the Appendix for data from the Save Our Communities organization regarding the various possible definitions of air taxi, commuter, and regional airlines.

It is assumed in the forecast calculations that commuter/regional aircraft will provide service only to destinations within 500 miles and will primarily utilize aircraft seating less than 60 passengers (e.g. DHC-6, DHC-7, DHC-8-200/300, EMB-120, BAe 146, Fokker F-27, etc.). Also included in the commuter/regional aircraft fleet are several regional jet types (e.g., EMB-135/145, CRJ-200, Fokker F-28, etc.), which are now being utilized in numerous markets in the United States (including SEA-TAC) for short-haul destinations. The "less than 60 passenger" assumption relating to commuter/regional aircraft will only be utilized in the demand forecasts section of this document. Analysis related to noise and facility needs require more refined aircraft type determinations.

The assumptions used relating to air carrier aircraft operations include:

- Domestic air carrier aircraft had an average seating capacity of 149.7 in 1999, which is less than the FAA forecasted in the early 1990s. The FAA projects this to gradually increase to 158.5 in 2011. Because air carrier operations at Paine Field would primarily be focused on shorter stage length trips, the *Paine Field Master Plan Update* forecasts are based on the average seating capacity of air carrier aircraft remaining at 147 through the end of the planning period (the combined average seating capacity of the B-737-300, the MD-80, and the Boeing next generation aircraft, B-737-700/800/900).

- Domestic air carriers achieved a 69.8 percent load factor in 1999, significantly more than the FAA forecasted in the early 1990's. This forecast uses the new projected load factors of 69.3 percent for 2000, decreasing to 68.3 percent in 2002, increasing to 69.5 percent in 2005 and 70.0 percent in the years 2006-2011. Beyond the year 2011, the forecasts will continue to be based on a load factor of 70.0 percent for air carrier aircraft.

The assumptions used relating to commuter/regional aircraft operations include:

- FAA indicates that commuter/regional aircraft average seating capacity grew from 22.9 in 1992 to 36.0 in 1999 and is projected to grow to 44.3 in 2011 (a 2.1% annual growth rate). This reflects the introduction of many larger aircraft, including regional jets into the market. Beyond the year 2011, the forecasts are based on the average commuter/regional aircraft seating capacity remaining at 44.3. (This growth of aircraft seating capacity is the impetus for the reduction of operations depicted in the following figure, entitled *UNCONSTRAINED AIR CARRIER & COMMUTER OPERATIONS DEMAND FORECAST SCENARIOS*).

- FAA indicates that the average commuter/regional load factor was 48.3 in 1992, increased to 57.6 percent in 1999, and is forecast to grow to 61.6 in 2011. Beyond the year 2011, the forecasts are based on a load factor remaining at 61.6 percent for commuter/regional aircraft.

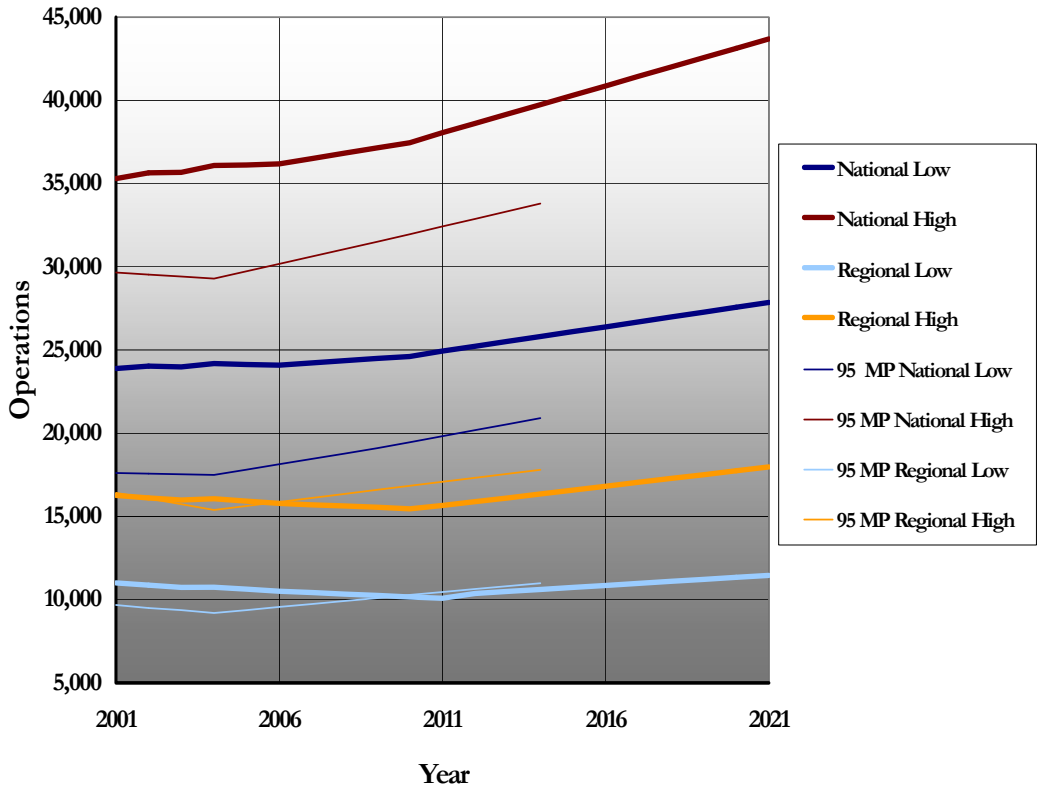
It may be of interest to note that in the 1995 MP, domestic air carriers had an average seating capacity of 151.1, while achieving a 62.6% load factor, and regional carriers had an average seating capacity of 22.9, while achieving a 48.3% load factor. Operations demand forecast is presented below in the following table, entitled *UNCONSTRAINED AIR CARRIER & COMMUTER OPERATIONS DEMAND FORECAST, 2001-2021.* In addition to the four forecast scenarios, the following table also presents forecasts from the *Flight Plan*.

Table B3
UNCONSTRAINED AIR CARRIER & COMMUTER OPERATIONS DEMAND FORECAST, 2001-2021
Paine Field Master Plan Update

Year	Flight Plan	Scenario 1 National Service Low Range	Scenario 2 National Service High Range	Scenario 3 Regional Service Low Range	Scenario 4 Regional Service High Range
2001	---	23,893	35,305	11,005	16,261
2002	---	24,042	35,647	10,873	16,121
2003	---	23,985	35,680	10,745	15,984
2004	33,760	24,185	36,093	10,759	16,057
2005	---	24,128	36,121	10,635	15,921
2006	---	24,094	36,178	10,514	15,788
2009	35,460	24,489	37,145	10,252	15,551
2011	---	24,934	38,057	10,259	15,659
2014	35,400	25,811	39,746	10,620	16,354
2016	---	26,396	40,872	10,861	16,817
2021	---	27,858	43,687	11,462	17,975

Flight Plan	Interpolated from Alternate #14, The Flight Plan Project, Draft Final Report and Final Environmental Impact Statement, 1992, Puget Sound Regional Council.
National Service	Forecast with Airport served by national and regional air carriers.
Regional Service	Forecast with Airport served by regional air carriers only.
Low Range	Enplanements captured only from area within 30 minute drive time.
High Range	Enplanements captured from area within 30 minute drive time and from all of Snohomish, Skagit, and Island counties.
Note:	Although passenger enplanement demand is forecast to increase, the number of commercial service operations is forecast to remain stable or increase only slightly because of increasing seating capacity of aircraft and increasing load factors (see assumptions in text above).

Figure B3
UNCONSTRAINED AIR CARRIER & COMMUTER OPERATIONS DEMAND FORECAST SCENARIOS
Paine Field Master Plan Update



Decrease in operations from 2010-2011 for the MP Update is reflective of an increase in average seats per aircraft from 36 to 44.3.

Manufacturing/Maintenance Large Transport Activity

There are currently two aviation manufacturing/maintenance organizations located at Paine Field, the Boeing Company and Goodrich. Large transport jet aircraft flight operations associated with these businesses (utilizing the same aircraft types as those used for "air carrier" passenger and freight activity) are conducted at Paine Field; however, because these operations are not related to commercial passenger service, they

have not been taken into consideration in the table above. Existing and projected flight operations at the airport associated with these two companies are presented in the following table entitled, *MANUFACTURING/MAINTENANCE LARGE TRANSPORT AIRCRAFT ACTIVITY FORECAST.* The types of aircraft expected to be operating at Paine Field by the Boeing Company include the B-737, B-747, B-757, B-767 and B-777. In addition to these aircraft, flight operations forecast for Goodrich also include the B-727, along with the MD-80 and DC-10 aircraft. Boeing is currently evaluating the option of relocating their B-737 and B-757 aircraft assembly operation from Renton to Paine Field. According to the *FAA Terminal Area Forecasts,* there were approximately 378 air carrier operations conducted at Renton Municipal Airport. These additional operations could be expected at Paine Field if the Boeing relocation were to come to fruition. Additionally, this number could also grow if the B-737/B-757 operations from Boeing Field/King County International Airport were also transferred to Paine Field.

Table B4
MANUFACTURING/MAINTENANCE LARGE TRANSPORT AIRCRAFT ACTIVITY FORECAST
Paine Field Master Plan Update

Year	Master Plan Forecast
2000[1]	3,443
2001	3,500
2002	6,000
2003	6,000
2004	6,000
2005	6,000
2006	6,000
2011	6,000
2016	6,000
2021	6,000

[1] Actual

Unconstrained Military Aircraft Operations Forecast

Military aircraft have historically utilized Paine Field. In years past, the U.S. Army Aviation Support Facility located on Paine Field was responsible for a majority of the operations. However, in September 1996, this squadron relocated from Paine Field to Fort Lewis reducing the number of military operations conducted at the airport. Currently, the primary military use is related to C-9 and C-12 aircraft, supporting the Everett based aircraft carrier – U.S.S. Lincoln, which regularly visits the field picking up or delivering sailors and their equipment, as well as EA-6Bs stationed at Whidbey Island Naval Air Station (NAS). Therefore, due to a lack of information associated with projecting an increase or decrease of military activity, it is projected that the demand for military operational activity at Paine Field will remain at existing levels through the end of the planning period. The following table, entitled *UNCONSTRAINED MILITARY OPERATIONS FORECAST, 2000-2021,* indicates the anticipated number of military operations during the planning period. The FAA's *Terminal Area Forecasts* have been included for comparison with the projections resulting from this study.

Table B5
UNCONSTRAINED MILITARY OPERATIONS FORECAST, 2000-2021
Paine Field Master Plan Update

Year	Terminal Area Forecast[2]	Master Plan Forecast
2000[1]	1,919	2,037[1]
2001	1,919	2,000
2002	1,919	2,000
2003	1,919	2,000
2004	1,919	2,000
2005	1,919	2,000
2006	1,919	2,000
2011	1,919	2,000
2016	1,919	2,000
2021	1,919	2,000

[1] Actual
[2] Terminal Area Forecasts Fiscal Years 1995-2015, FAA

General Aviation Operations Forecast

General aviation operations at Paine Field have historically been affected by fluctuations in the regional and national economy. This is reflected in the overall decrease in training and private use of aircraft during periods of economic decline. Although more of the general aviation fleet is now used for business purposes than it was ten or more years ago, the economy continues to affect total general aviation operations.

During the past ten years, the annual number of general aviation operations at Paine Field reached a high in 2000 with approximately 203,925 operations. The lowest number of annual general aviation operations was recorded in 1990, with 144,943 operations. It should also be noted that during the past decade, the number of general aviation operations at Paine Field has consistently increased, with only slight declines noted in 1994, 1995, and 1996. As discussed previously, growth in general aviation operations nationally has been inhibited during the 1980s and early 1990s by the high operating and ownership costs of aircraft.

FAA Aviation Forecasts Fiscal Years, 2000-2011, indicates that nationally, general aviation hours flown are expected to increase at an annual rate of approximately 2.1% until the year 2011. A projection based on a 2.1% annual increase in the number of general aviation operations is presented in the "Low Forecast" column of the following table. Turbine powered general aviation aircraft use is projected by the FAA to increase at a 4.9% annual growth rate between 2000 and 2011. Paine Field experiences a significant amount of turboprop and business jet activity. A projection based on 4.9% annual growth is presented in the High Forecast column below.

Construction of one corporate hangar capable of accommodating two aircraft, as well as permit approval for an additional eleven corporate units is currently in progress. Because of the large number of individuals on the airport's hangar waiting list (approximately 115), the airport is proceeding with a development process that could potentially add up to 100 additional T-hangar units by the year 2006. Interviews with businesses providing flight training on the airport indicate that significant growth in flight training activity at Paine Field is likely during the next few years. Due to the closing of Martha Lake Airport, coupled with the construction of new hangar space and flight training optimism, the selected forecast for general aviation operation demand is based on a more rapid growth rate in the first years of the planning period. This growth rate is tempered in later years (particularly due to the relatively flat historic trend in general aviation operations at the airport).

Another factor that supports a forecast of significant growth in general aviation activity during the first few years of the planning period is the historical and forecast population growth rate. The U.S. Census Bureau reports Snohomish County population grew from

465,628 people in 1990 to 606,024 in 2000. That is a 30.2% growth compared to the U.S. average of 13.1%, making Snohomish County the 38th fastest growing county in the U.S. and the fastest growing county in the Central Puget Sound Region. In 1999, the Puget Sound Regional Council forecast Snohomish County population to grow by 138,399 (23%) between 2000 and 2010 and by 112,198 between 2010 and 2020. So, it is not unreasonable that growth in general aviation operations and based aircraft would increase at a faster rate during the first few years of the planning period, while tapering off during the later years. Therefore, a 4.9% annual growth rate was used in years 2001-2006 and a 1.5% annual growth rate was used for forecast years 2007-2021.

Table B6
GENERAL AVIATION OPERATIONS FORECAST, 2000-2021
Paine Field Master Plan Update

Year	TAF	1995 MP	TP	Low Forecast	High Forecast	Selected Forecast
2000(1)	191,824	---	203,925[1]	203,925[1]	203,925[1]	203,925[1]
2001	195,503	---	196,987	208,207	213,917	213,399
2002	199,258	---	201,092	212,580	224,399	224,399
2003	203,089	---	205,198	217,044	235,395	235,395
2004	206,999	223,000	209,304	221,602	246,929	246,929
2005	210,988	---	213,409	226,256	259,029	259,029
2006	215,060	---	217,515	231,007	271,721	271,721
2011	236,703	---	238,044	256,303	345,144	292,721
2014	250,783	256,000	250,361	250,494	398,407	306,092
2015	255,670	---	254,467	254,201	417,929	310,683
2016	---	---	258,572	284,369	438,408	315,343
2021	---	---	279,101	315,508	556,872	339,714

Source: [1] Actual (includes Air Taxi operations)
TAF: Terminal Area Forecasts Fiscal Years 1990-2015, FAA
TP: Trend Projection Using General Aviation Annual Operations in years 1990-2000 as basis.

Air Cargo Activity Forecast

Historically, airmail and airfreight activity has occurred at Paine Field to a limited degree. These air cargo operations have been conducted at the airport with small air taxi type aircraft (prop aircraft with the capability of seating less than sixty passengers). This includes a scheduled mail route (by Methow Airlines), which transports mail from the regional postal facility in Everett to the San Juan Islands and a number of aircraft hauling checks (AMERIFLIGHT). Operations related to air cargo activity at the airport have been counted under the "Air Taxi" category of operations in Airport Traffic Control Tower data. In 2000, there were 3,886 operations recorded as "Air Taxi", which also included some non-scheduled passenger aircraft operations in addition to air freight operations.

Although significant demand for air cargo operations at Paine Field may be present, air cargo activity at the airport is likely to be limited. Factors contributing to this assumption relate to the County's 1978/1979 Mediated Role Determination to discourage increases in air freight activity at Paine Field and, due to the location of Paine Field (northern region of the Metropolitan area away from the "centroid" of Metropolitan collection areas), cargo operators will be less inclined to utilize Paine Field because of its lack of "centralized" geography. Because air cargo companies operating at SEA-TAC and Boeing Field would benefit from this "centralized" location, it can be assumed that they will prefer to remain in their current locations.

Due to the construction at SEA-TAC over the next several years with the North End Aviation Terminal (NEAT), which will displace approximately 40% of the SEA-TAC cargo hardstands and the lack of adequate developable areas at Boeing Field, the ability to accommodate cargo operations at its current level will be reduced. As a result, cargo operators may have to temporarily relocate to alternate airports within the region. For this planning effort, it is assumed that, if there is a demand for cargo operations at Paine Field, it is likely to be only temporary, until the cargo use area at SEA-TAC is re-established when (and if) the Port of Seattle moves forward with construction of the South Aviation Support Area (SASA) at SEA-TAC.

Operations Forecast By Aircraft Type

Now that total numbers of aircraft operations have been projected, the next step in the forecasting process is to detail the various types of aircraft that will operate at the airport. The following table, entitled *SUMMARY OF OPERATIONS DEMAND FORECAST BY AIRCRAFT TYPE, 2000-2021*, presents that detail.

As can be noted, total annual operations are anticipated to increase during the planning period. The forecasts indicate that total annual operational demand is expected to

Table B7
SUMMARY OF OPERATIONS DEMAND FORECAST BY AIRCRAFT TYPE, 2000-2021
Paine Field Master Plan Update

Operations By Type	2000[1]	2006	2011	2016	2021
Industrial Air Carrier					
Jet	**3,443**	**6,000**	**6,000**	**6,000**	**6,000**
Military	**2,037**	**2,000**	**2,000**	**2,000**	**2,000**
General Aviation	**207,891**	**271,721**	**292,721**	**315,343**	**339,714**
Single Engine Piston	176,731	228,241	242,961	258,583	275,154
Multi-Engine Piston	16,620	21,470	22,830	24,280	25,820
Turboprop	6,230	9,510	11,710	14,190	16,990
Business Jet	6,230	9,510	11,710	14,190	16,990
Helicopter	2,080	2,990	3,510	4,100	4,760
Instrument[2]	28,256	**37,650**	**40,773**	**43,898**	**47,002**
TOTAL WITHOUT COMMERCIAL PASSENGER AIRCRAFT	**213,371**	**279,721**	**300,721**	**323,343**	**347,714**
Passenger Air Carrier/Commuter					
Scenario 1 (National Low)	---	**24,094**	**24,934**	**26,396**	**27,858**
Jet	---	17,259	19,804	20,965	22,127
Turboprop	---	6,835	5,130	5,431	5,731
Scenario 2 (National High)	---	**36,178**	**38,057**	**40,872**	**43,687**
Jet	---	25,915	30,227	32,463	34,699
Turboprop	---	10,263	7,830	8,409	8,988
Scenario 3 (Regional Low)	---	**10,514**	**10,259**	**10,861**	**11,462**
Jet	---	3,679	5,129	5,430	5,731
Turboprop	---	6,835	5,130	5,431	5,731
Scenario 4 (Regional High)	---	**15,788**	**15,659**	**16,817**	**17,975**
Jet	---	5,525	7,829	8,408	8,987
Turboprop	---	10,263	7,830	8,409	8,988
TOTAL ANNUAL OPERATIONS					
SCENARIO 1 (National Low)	**213,371**	**303,815**	**325,655**	**349,739**	**375,572**
SCENARIO 2 (National High)	**213,371**	**315,899**	**338,778**	**364,215**	**391,401**
SCENARIO 3 (Regional Low)	**213,371**	**290,235**	**310,980**	**334,204**	**359,176**
SCENARIO 4 (Regional High)	**213,371**	**295,509**	**316,380**	**340,160**	**365,689**

Source: Barnard Dunkelberg & Co.
[1] Existing
[2] Instrument operations are not an additive element with regard to total operations.

increase by approximately 78% with the highest scenario (Scenario 2), and by approximately 71% with the lowest scenario (Scenario 3) by the year 2021.

The largest increase in operational demand is expected in the General Aviation category, with demand for approximately 130,000 additional operations during the 20-year planning period. General aviation operational demand is expected to grow most rapidly with the turboprop, jet, and helicopter types of aircraft. Industrial Air Carrier demand is expected to grow somewhat, with all of the activity being related to large air carrier jets. Military activity is expected to remain at its current level and will continue to be made up primarily of C-9 and EA-6B operations.

Passenger aircraft operational demand is presented in the four scenarios, which have been previously discussed. Within the passenger aircraft category, the split between jet and turboprop aircraft varies depending on forecast year and scenario. The *FAA AEROSPACE OPERATIONS, FISCAL YEARS 2000-2011,* states that 15.3% of the current national commuter/regional fleet accounts for regional jets, and the remaining 84.7% accounts for turboprops. The FAA forecasts these figures to become a 50/50 split by the year 2011. In Scenario 1 and Scenario 2, demand for air carrier jet aircraft operations represents approximately 65% of the total demand for passenger aircraft operations at the airport in 2021. In Scenario 3 and Scenario 4, projections of jet aircraft for the year 2006 were calculated using the difference of the current percentage and the forecast percentage (34.7%), and projections for the remaining years were calculated with the even percentage split of 50/50. As stated previously, it is assumed in the forecast calculations that commuter/regional aircraft will be aircraft seating less than 60 passengers; however, regional jets are now being utilized in several markets in the United States (including SEA-TAC) for short-haul destinations and could be present in the commuter/regional aircraft fleet at Paine Field.

Instrument Operations

As described earlier, instrument aircraft operations are those operations conducted by aircraft filing an IFR flight plan operating in the vicinity of Paine Field. Instrument operations forecasts, shown in the following table, *INSTRUMENT OPERATIONS,* are taken from, or extrapolated from the TAF Forecast produced by the FAA for Paine Field. As a note, instrument operations are not an additive element with regard to total operations conducted at the airport.

Table B8
INSTRUMENT OPERATIONS
Paine Field Master Plan Update

Year	Instrument Operations Forecast[2]
2000[1]	28,256
2001	34,627
2002	35,224
2003	35,824
2004	36,429
2005	37,037
2006	37,650
2011	40,773
2016	43,898
2021	47,002

Source: [1] Actual
[2] Master Plan Update instrument operations were taken from the FAA Terminal Area Forecasts, Fiscal Years, 1995-2015.

Based Aircraft Forecast

General Aviation Based Aircraft

The number of general aviation aircraft that can be expected to be based at an airport facility is dependent upon several factors, such as airport communication practices, aircraft maintenance facilities, airport operator's services, airport proximity and access, and similar factors. In an effort to plan for the proper number and size of future aircraft storage areas, it is important to forecast the number of general aviation based aircraft.

The number and type of aircraft anticipated to be based at an airport are vital components in developing the plan for the airport. Depending on the potential market and forecast, the airport will tailor the plan in response to anticipated demand. Generally, there is a relationship between aviation activity and based aircraft, stated in terms of operations per based aircraft (OPBA). Sometimes, a trend can be established from historical information of operations and based aircraft. The national trend has been changing with more aircraft being used for business purposes and less for pleasure flying. This impacts the OPBA in that business aircraft are usually flown more often than pleasure aircraft. In 2000, the OPBA at Paine Field was approximately 429, above the

average OPBA of 358 for the past ten years. It is expected that the number of operations per based aircraft will increase at the airport as more aircraft based there are used for business purposes.

The following table, entitled *UNCONSTRAINED GENERAL AVIATION BASED AIRCRAFT FORECAST, 2000-2021,* presents the forecasts for the next twenty-year period. For information and comparison purposes, also noted are the projections based on the FAA forecast, which indicates that the active general aviation fleet is expected to grow at an annual rate of 1.4 %. Because of new hangar units, which will be completed in 2001 and 2002, the airport is expected to increase its based aircraft fleet significantly in the near-term. The forecast for the Paine Field Master Plan Update is based on a rate of growth higher than that which is expected nationally during the early years of the 20-year planning period, with that rate of growth tapering off during the latter years.

The airport has received proposals for long-term commercial development of the lower elevation section of airport property west of Runway 16R/34L, between Runway 11 and Taxiway K-5. This area was designated in the 1995 and subsequent Airport Layout Plans for Aviation compatible commercial/industrial development. This forecast has included an additional analysis of based aircraft demand through the year 2051 to confirm that area will not be needed to accommodate airport storage facilities. Using the same average annual percentage increase used in this MP Update of 1.4%, this analysis derived a projection of 980 based aircraft by the year 2051. This projection would equate to a demand for approximately 66 acres of aircraft storage (hangar and apron). Even this long-term projection of demand can be accommodated with the areas of the airport that are at, or close to, runway elevation grade. Thus, the need for a large area of the west side to accommodate future general aviation based aircraft storage is forecast to be minimal.

Table B9
UNCONSTRAINED GENERAL AVIATION BASED AIRCRAFT FORECAST, 2000-2021
Paine Field Master Plan Update

Year	Puget Sound, 2001 Regional Airport System Plan	FAA Forecast	Master Plan Forecast
2000	---	480	479[1]
2001	---	489	490
2005	542	---	550
2006	---	525	564
2010	575	---	590
2011	---	559	597
2015	605	587	622
2016	---	---	629
2020	639	---	643
2021	---	---	646

Source: Barnard Dunkelberg & Co.
[1] Actual.

The number of based aircraft at Paine Field is expected to increase by approximately 30% during the twenty-year planning period. The mix of based aircraft for incremental periods throughout the planning period is shown in the following table, entitled *GENERAL AVIATION BASED AIRCRAFT FLEET MIX, 2000-2051.* The percentage of business jets, multi-engine (including turboprops), and helicopters is expected to increase as a part of the total based aircraft population at the airport. This is in line, first of all, with overall trends in general aviation, but even more importantly, parallels the industrial, economic development and growth expectations and projections characteristic to Paine Field. By the end of the planning period, single engine aircraft are anticipated to comprise approximately 80.3% of the total based aircraft at Paine Field, with approximately 8.7% being multi-engine piston, 3.4% being turbine prop aircraft, approximately 5.1% being business jet aircraft, and approximately 2.5% being helicopters.

Table B10
GENERAL AVIATION BASED AIRCRAFT FLEET MIX, 2000-2051
Paine Field Master Plan Update

Aircraft Type	2000[1]	2006	2011	2016	2021	***2051[2]***
Single Engine	418	481	501	518	519	*788*
Multi-Engine	45	50	53	55	56	*85*
Turbo Prop	6	14	15	18	22	*33*
Jet	6	12	18	25	33	*50*
Helicopter	4	7	10	13	16	*24*
TOTAL	479	564	597	629	646	*980*

Source: [1] Actual
[2] FAA does not require Master Plans to forecast this year.

Summary

Paine Field will continue to be the primary general aviation and industrial aviation airport serving Snohomish County and the northern portion of the Seattle Metropolitan area. In addition, the forecasts indicate that, to some degree, there is unconstrained demand for commercial passenger service at an airport in the vicinity of Paine Field. As described in The Puget Sound Regional Council's (PSRC) Metropolitan Transportation Plan, *Destination 2030*, "the region will meet its long-term commercial air transportation needs consistent with the Regional Council's General Assembly action in 1996. *Destination 2030* continues prior actions to include plans for a third runway at SEA-TAC Airport, with additional noise reduction measures, implementation measures, and monitoring steps". Additionally, the most notable change in the Master Plan Update, as compared with the previous Master Plan, is that due to the increase in population and the number of originating passenger trips, a larger PAX^{do}/POP ratio has been applied to the national and regional enplenement and operation scenarios.

The primary purpose of a master planning document is to formulate a program to accommodate a reasonable projection of anticipated aviation activity demand. Although this "reasonable level of demand" will be used as a basis for long-term facility planning in the master plan update, no facilities will be built until actual demand occurs. In other words, market forces drive facility development, not forecasts.

The following illustration, entitled *OPERATIONS DEMAND FORECAST SUMMARY, 2000-2021*, and following table, entitled *SUMMARY OF AVIATION ACTIVITY FORECASTS, 2000-2021*, summarize the forecasts of aviation activity that have been presented in this

chapter. As stated previously, the forecasts presented in this chapter are based on "unconstrained demand", without regard to site-specific physical or environmental constraints. It is realized that conditions on the airport and in the area surrounding the airport will influence the type and quantity of aviation activity that can be reasonably accommodated. The next steps in the master planning process are to identify the capacity of existing airport facilities and to convert forecasts of aviation activity into facility requirements. In order to identify a reasonable and feasible facility development plan, an analysis is also necessary which compares the physical needs of various alternatives to available development potentials through an opportunities/constraints process.

Figure B4
OPERATIONS DEMAND FORECAST SUMMARY, 2001-2021
Paine Field Master Plan Update

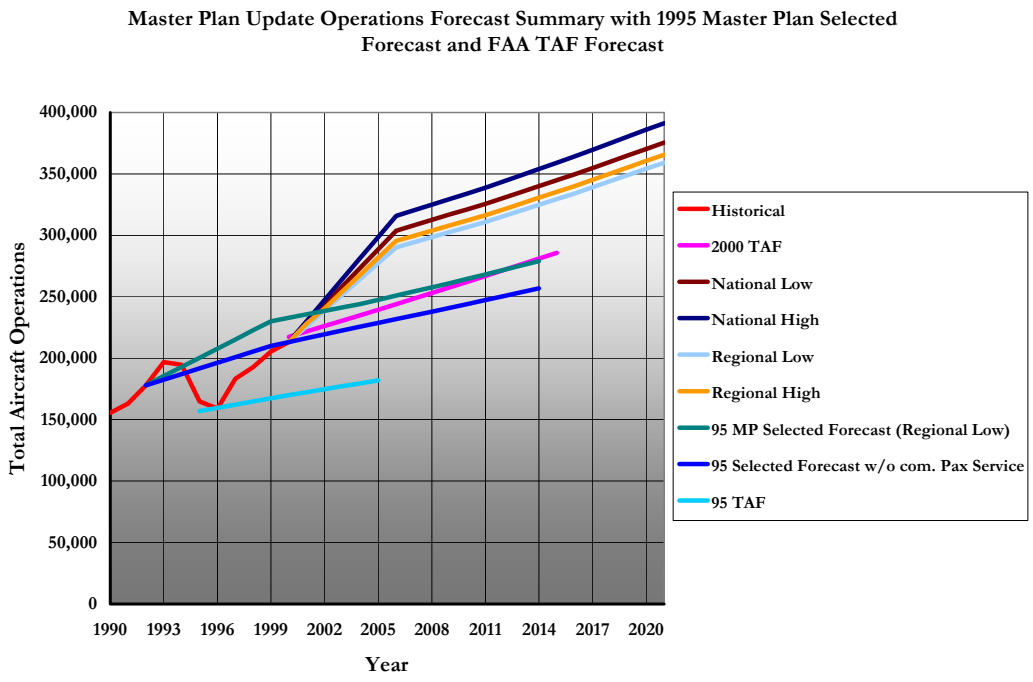


Table B11
SUMMARY OF AVIATION ACTIVITY FORECASTS, 2000-2021
Paine Field Master Plan Update

Operations	**2000** [1]	**2006**	**2011**	**2016**	**2021**
Air Carrier/Commuter					
Scenario 1 (National Low)	---	24,094	24,934	26,396	27,858
Scenario 2 (National High)	---	36,178	38,057	40,872	43,687
Scenario 3 (Regional Low)	---	10,514	10,259	10,861	11,462
Scenario 4 (Regional High)	---	15,788	15,659	16,817	17,975
Other Jet Transport	3,443	6,000	6,000	6,000	6,000
Military	2,037	2,000	2,000	2,000	2,000
General Aviation	207,891	271,721	292,721	315,343	339,714
Instrument[2]	28,256	37,650	40,773	43,898	47,002
Total Annual Operations					
Scenario 1	213,371	303,815	325,655	349,739	375,572
Scenario 2	213,371	315,899	338,778	364,215	391,401
Scenario 3	213,371	290,235	310,980	334,204	359,176
Scenario 4	213,371	295,509	316,380	340,160	365,689
Passenger Enplanements					
Scenario 1	---	825,096	891,634	943,907	996,180
Scenario 2	---	1,238,910	1,360,887	1,461,553	1,562,219
Scenario 3	---	126,425	136,621	144,630	152,640
Scenario 4	---	189,832	208,522	223,946	239,371
Based Aircraft					
Single Engine	418	481	501	518	519
Multi-Engine	45	50	53	55	56
Turboprop	6	14	15	18	22
Business Jet	2	12	18	25	33
Helicopter	4	7	10	13	16
TOTAL BASED AIRCRAFT	475	564	597	629	646

Source: [1] Actual
[2] Instrument Operations are not an additive element with regard to total operations.

Adopted Forecast

Up to this point four different scenarios of unconstrained commercial passenger demand have been provided. On July 25, 2001, the Snohomish County Council adopted the regional-low forecast scenario for use in this Airport Master Plan Update. A copy of the motion adopting the forecasts is provided in the Appendix. The regional-low forecast for passenger enplanements (boardings) is the lowest of the four scenarios and is based on the assumption that, if actual demand occurs, the airport is most likely to accommodate passengers from a limited geographic area surrounding the airport (a thirty minute drive time), and that routes flown out of the airport will have a regional focus (within a 500-mile range).

It is recognized that the passenger enplanement projections are based on an unconstrained forecasting model. Market constraints exist which are likely to limit demand, especially for commercial passenger facilities at Paine Field. Although a plan for the development of Paine Field has been prepared using the adopted forecast as a basis, construction of facilities should only begin when an appropriate level of actual demand is experienced or eminent.

Some of the underlying reasons considered in arriving at the adopted forecast include:

- The forecasting of aviation activity at an airport is not an exact science and realized numbers are likely to be higher or lower than those that have been predicted. Therefore, facilities should be constructed only to accommodate actual demand, not forecast demand. This Master Plan Update study does not include a market feasibility study for commercial passenger service at Paine Field.

  An airport master plan is intended to be a document that is updated when development influences change significantly. In fact, the FAA anticipates that at an airport of this nature, an airport master plan should be updated approximately every five years. If demand is realized for larger passenger facilities, it should trigger another planning effort for Paine Field.

- The area identified for the development of passenger facilities at Paine Field is in the vicinity of the existing terminal/airport administrative offices. This area of the airport exhibits the best landside and airside access qualities related to those required for commercial passenger service facilities. Exact location recommendations will be dependent on the level of demand experienced. Passenger facilities and size of these facilities will be examined in detail in subsequent chapters.

- Because of the narrow shape of the airport's west side, it is inappropriate to program a parallel taxiway on the west side of Runway 16R/34L. Without a parallel taxiway, the west side area is inappropriate for an aviation activity intensive function such as flight training or a passenger terminal.

- In consideration of the additional analysis of future based aircraft demand for the lower elevation central portion of the west side of Runway 16R/34L (between Taxiway K-5 and Runway 11 beyond 950 feet west of Runway 16R/34L centerline) will not be needed for aircraft storage facilities within the next fifty years.

- Scenarios 3 and 4 (regional low and regional high) forecasts are consistent with the 1978/79 Mediated Role Determination defined for Paine Field (although the forecasts do not specifically limit passenger aircraft types or sizes).

- The on-airport roadway system, along with the roadway system surrounding Paine Field, is constrained in its ability to accommodate additional vehicular traffic. Of the considered Scenarios, passenger traffic related to Scenario 3 will least impact the regional roadway system.

Capacity Analysis and Facility Requirements

Introduction

The capacity analysis for Paine Field is composed of two distinct elements: the ability of airport facilities to accommodate existing and projected aircraft operations (airfield capacity) and the ability of airport facilities to accommodate existing and projected ground vehicle operations (airport access capacity). The capacity of an airfield is primarily a function of the major aircraft traffic surfaces (runways and taxiways) that composes the facility and the configuration of those surfaces, but it is also related to, and considered in conjunction with, wind coverage, airspace utilization, and the availability and type of navigational aids. Airport access capacity is a function of the existing and/or future vehicular roadways located in the vicinity of the airport and their interface with the various airport specific access roads.

The capacity of the existing airfield and access facilities is analyzed with respect to the ability of each to accommodate current and forecast demand. This analysis aids in the identification of possible deficiencies in the present and/or future airport physical plant.

Airfield Capacity Methodology

This section addresses the evaluation method used to determine the capability of the airside facilities to accommodate aviation operational demand. Evaluation of this capability is expressed in terms of potential excesses and deficiencies in capacity. The methodology utilized for the measurement of airfield capacity in this study is described in FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*. From this methodology, airfield capacity is defined in the following terms:

- *Hourly Capacity of Runways:* The maximum number of aircraft that can be accommodated under conditions of continuous demand during a one-hour period.

- *Annual Service Volume (ASV):* A reasonable estimate of an airport's annual capacity (i.e., the level of annual aircraft operations that will result in an average annual aircraft delay of approximately one to four minutes).

The capacity of an airport's airside facilities is a function of several factors. These include the layout of the airfield, local environmental conditions, specific characteristics of local aviation demand, and air traffic control requirements. The relationship of these factors and their cumulative impact on airfield capacity is examined in the following paragraphs.

Airfield Layout

The layout or "design" of the airfield refers to the arrangement and interaction of the airfield components, which include the runway system, taxiways, and ramp entrances. As previously described, Paine Field is operated around three runways. Runway 16R/34L is the primary runway served by an east side full-length parallel taxiway (Taxiway A). Runway 16L/34R, the secondary parallel runway, is served by two full-length parallel taxiways, Taxiway F on the east side and Taxiway G on the west side. Runway 11/29, the crosswind runway, is served by a full-length northeast side parallel taxiway (Taxiway D) and an additional partial parallel taxiway (Taxiway C). This runway system is served by several runway exit taxiways and connector taxiways designed to minimize aircraft runway occupancy times, thus increasing the capacity of the runway system.

In general, the airport's existing landside facilities are well distributed around airport property, with the exception of the west side, which is primarily undeveloped. Located on the northeast portion of airport property, east of Airport Road, is the BOMARC Business Park complex. The Boeing Company aircraft assembly facility is located immediately north and east of the airport. The airport's administration offices, general aviation hangar and apron areas, the airport air traffic control tower, fuel storage facilities, facilities associated with Everett Community College, and the Museum of Flight are located on the north central portion of the airfield. Goodrich Inc. and the ARFF facilities are located on the southern portion of airport property, while general aviation facilities encompass the central and eastern portions of the airport. Each of these facilities is well situated to efficiently utilize the existing taxiway system.

Environmental Conditions

Climatological conditions specific to the location of an airport not only influence the layout of the airfield, but also impact the utilization of the runway system. Variations in the weather resulting in limited cloud ceilings and reduced visibility typically lower airfield capacity, while changes in wind direction and velocity typically dictate runway usage and also influence runway capacity.

Paine Field and the Puget Sound area exhibit a weather phenomenon known as the Puget Sound Convergence Zone. When the eastward flow of air from the Pacific Ocean meets the Olympic Mountains, it does one of two things, travels over the mountains or around the mountains. The path of least resistance in this case is around the mountains. Thus, airflow in the Sound occurs from both the north and the south producing large amounts of rainfall. When Paine Field experiences airflow from the north, Seattle may be experiencing just the opposite with airflow from the south. This phenomenon at times can play havoc on the local air traffic control system with two different flows of traffic into and out of airports thirty miles apart.

Ceiling and Visibility. FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, describes three categories of ceiling and visibility minimums for use in both capacity and delay calculations. Visual Flight Rules (VFR) conditions occur whenever the cloud ceiling is at least 1,000 feet above ground level and the visibility is at least three statute miles. Instrument Flight Rules (IFR) conditions occur when the reported cloud ceiling is at least 500 feet, but less than 1,000 feet and/or visibility is at least one statute mile, but less than three statute miles. Poor Visibility and Ceiling (PVC) conditions exist whenever the cloud ceiling is less than 500 feet and/or the visibility is less than one statute mile.

However, meteorological data obtained for Paine Field from the National Climatic Data Center for use in this study, has been categorized in more specific terms:

- VFR conditions - ceiling equal to or greater than 1,000 feet above ground level and visibility equal to or greater than 3 statute miles. These conditions occur at the airport approximately 89.1% of the time annually.
- VFR minimums to Category I ILS minimums - ceiling less than 1,000 feet and/or visibility less than 3 statute miles, but ceiling equal to or greater than 200 feet and visibility equal to or greater than ½ statute mile. These conditions occur at the airport approximately 8.9% of the time annually.
- Below minimums - ceiling less than 200 feet and/or visibility less than ½ statute mile. These conditions occur at the airport approximately 2% of the time annually.

Therefore, in consideration of the airport's existing approach instrumentation (i.e., the precision instrument approach to Runway 16R/34L and historical meteorological records), the airport can be expected to experience VFR conditions approximately 89.1% of the time, IFR conditions approximately 8.9% of the time, and below minimums approximately 2% of the time.

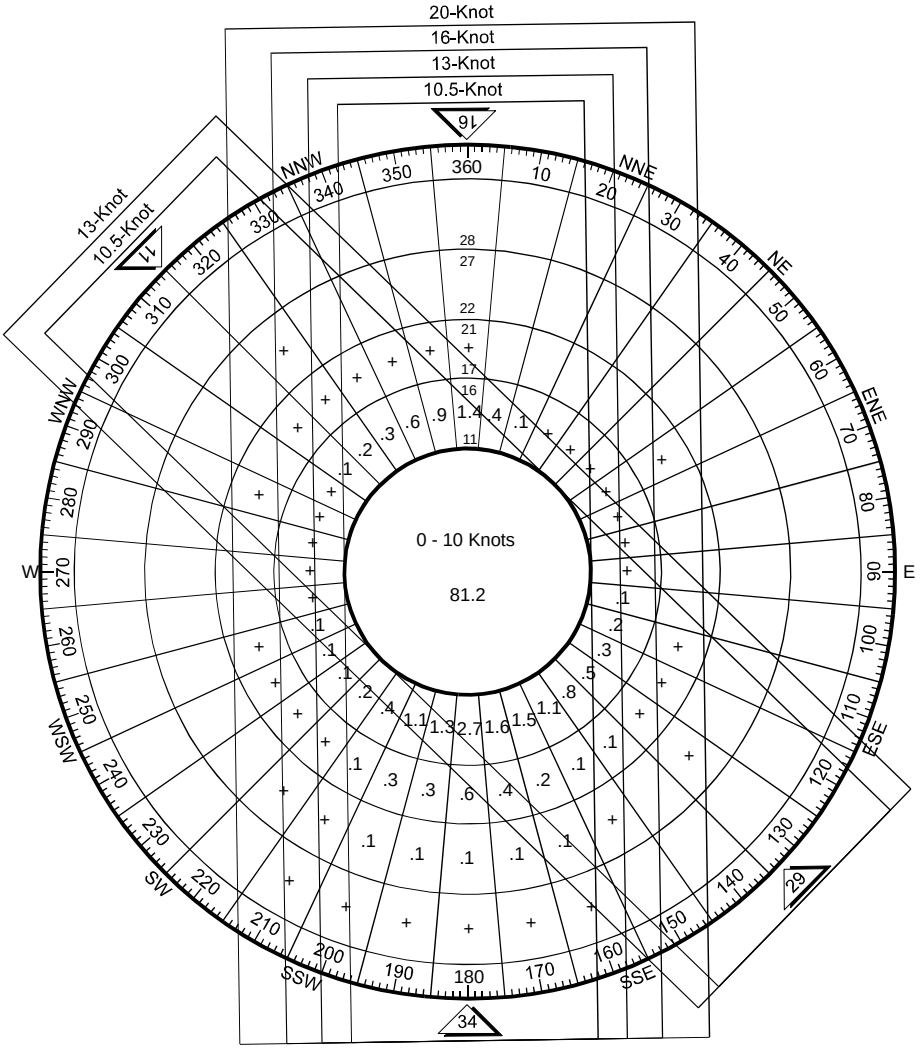
Wind Coverage. Surface wind conditions (i.e., direction and speed) generally determine the desired alignment and configuration of the runway system. Runways, which are not oriented to take advantage of prevailing winds, will restrict the capacity of the airport.

Wind conditions affect all airplanes in varying degrees; however, the ability to land and takeoff in crosswind conditions varies according to pilot proficiency and aircraft type. Generally, the smaller the aircraft, the more it is affected by the crosswind component.

To determine wind velocity and direction at Paine Field, wind data to construct the all weather wind rose was obtained for the period 1991-2000 from observations taken at the airport. There were approximately 51,068 observations available for analysis during this ten-year period. The allowable crosswind component is dependent upon the Airport Reference Code (ARC) for the type of aircraft which utilize the airport on a regular basis. According to the existing Airport Layout Plan, the current Airport Reference Code (ARC) for Runway 16R/34L is D-V.

In consideration of the ARC D-V classification, these standards specify that the 20-knot crosswind component be utilized for analysis. In addition, it is known that the airport will continue to also serve small single and twin-engine aircraft for which the 10.5-knot crosswind component is considered maximum; therefore, the 20-knot and 10.5-knot crosswind components should be analyzed for this airport. The following illustration, entitled *ALL WEATHER WIND ROSE: 20-, 16-, 13- & 10.5-KNOT CROSSWIND COMPONENTS*, illustrates the all weather wind coverage provided at Paine Field. For comparison purposes, the 13- and 16-knot crosswind components have also been included.

Figure C1
ALL WEATHER WIND ROSE: 20-, 16-, 13- & 10.5-KNOT CROSSWIND COMPONENTS
Paine Field Master Plan Update



Source: National Oceanic and Atmospheric Administration, National Climatic Data Center
Station # 72793 – Paine Field, Snohomish County, Everett, WA. Period of Record – 1991-2000. Total Observations: 51,068.

The desirable wind coverage for an airport's runway system is 95%. This means that the runway orientation and configuration should be developed so that the maximum

crosswind component is not exceeded more than 5% of the time annually. The following table, entitled *ALL WEATHER WIND COVERAGE SUMMARY*, quantifies the wind coverage offered by the airport's existing runway system, including the coverage for each runway end. Based on the all weather wind analysis for Paine Field, utilizing the FAA Airport Design Software supplied with AC 150/5300-13, the existing runway configuration provides 100.0% wind coverage for the 20-knot crosswind component, 99.99% wind coverage for the 16-knot crosswind component, 99.98% wind coverage for the 13-knot crosswind component, and 99.95% for the 10.5-knot crosswind component. Therefore, no additional runways are required from a *wind coverage* standpoint.

Table C1
ALL WEATHER WIND COVERAGE SUMMARY
Paine Field Master Plan Update

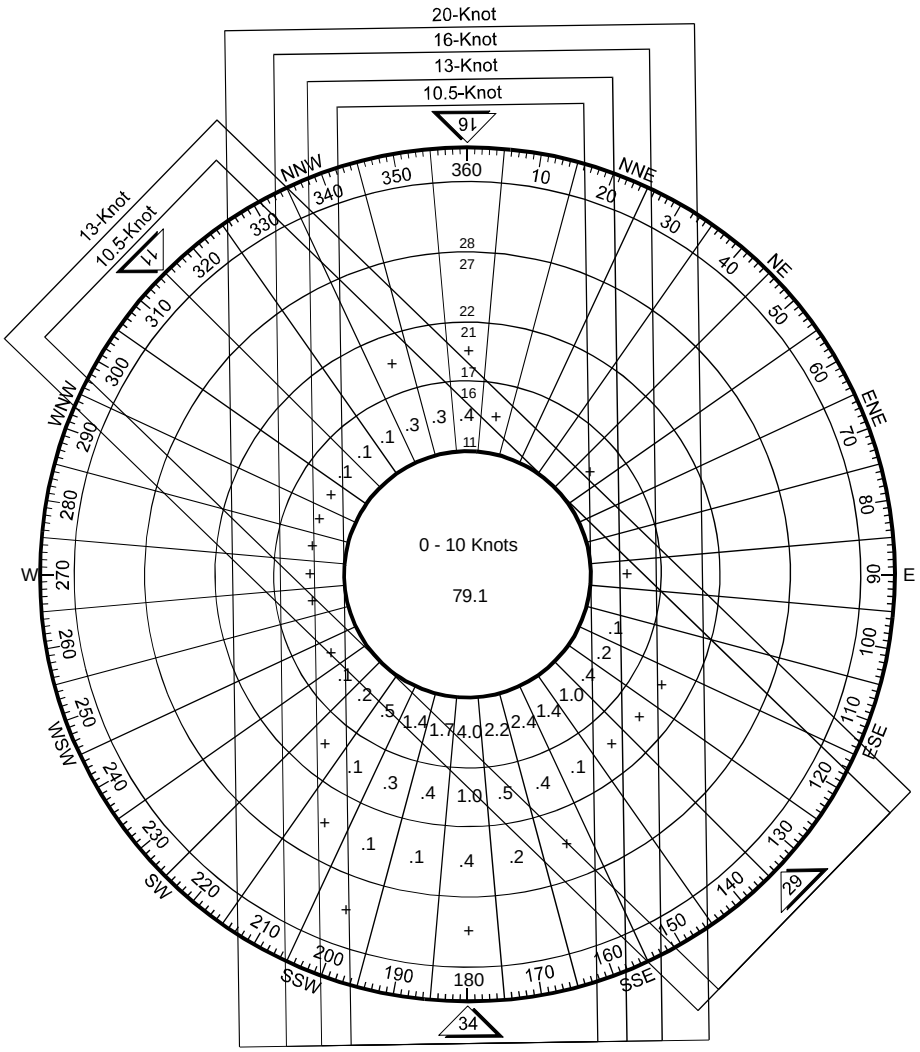
Runway Designation	20-Knot Crosswind Component	10.5-Knot Crosswind Component
Runway 16/34	99.99%	98.62%
Runway 16	74.80%	73.53%
Runway 34	65.63%	65.20%
Runway 11/29	99.83%	93.35%
Runway 11	77.09%	71.53%
Runway 29	65.98%	63.96%
Combined	100.0%	99.95%

Source: Wind analysis tabulation provided by Barnard Dunkelberg & Company utilizing the FAA Airport Design Software supplied with AC 150/5300-13.

It should be noted these statistics indicate that Runway 11/29 is rarely needed to provide crosswind coverage at Paine Field. There are, however, several other considerations that should be analyzed. These include the benefits provided by having a crosswind practice runway at an airport like Paine Field that is a center for flight training and the operational flexibility provided by having a 4,500-foot runway available for use if one of the other runways is temporarily closed for any reason.

The airport is served by a precision ILS and a VOR or GPS-B approach. In an effort to evaluate the effectiveness of these approaches, an Instrument Flight Rules (IFR) wind rose has been constructed. The following illustration and table quantify the wind coverage offered by each runway end.

Figure C2
IFR WEATHER WIND ROSE: 20-, 16-, 13- & 10.5-KNOT CROSSWIND COMPONENTS
Paine Field Master Plan Update



Source: National Oceanic and Atmospheric Administration, National Climatic Data Center
Station # 72793 – Paine Field, Snohomish County, Everett, WA. Period of Record – 1991-2000. Total Observations: 51,068.

Table C2
IFR WIND COVERAGE SUMMARY
Paine Field Master Plan Update

Runway Designation	Wind Coverage Provided Under IFR Conditions (1) 20-Knot Maximum Crosswind	Wind Coverage Provided Under IFR Conditions (1) 10.5-Knot Maximum Crosswind
Runway 16/34	100.00%	98.95%
Runway 16	85.35%	84.37%
Runway 34	50.48%	50.20%
Runway 11/29	99.75%	92.22%
Runway 11	87.50%	80.17%
Runway 29	55.46%	54.11%
Combined	100.0%	99.92%

Source: Wind analysis tabulation provided by Barnard Dunkelberg & Company utilizing the FAA Airport Design Software supplied with AC 150/5300-13.
(1) Ceiling of less than 1,000 feet, but equal to or greater than 200 feet and/or visibility less than 3 statute miles, but equal to or greater than ½ statute mile.

From this IFR wind coverage summary, it can be determined that Runway 16 provides better wind coverage for each crosswind component, which is where the existing precision instrument approach is located. However, additional analysis of a 34L precision approach will be undertaken to address future noise levels, as well as the alleviation of "head-to-head" flight operations. The information provided by this analysis will be incorporated into the formulation of various future airside development alternatives and the ultimate development recommendations for the airport.

Characteristics of Demand

Certain site-specific characteristics related to aviation use and aircraft fleet makeup impact the capacity of the airfield. These characteristics include runway use, aircraft mix, percent arrivals, touch-and-go operations, and exit taxiways.

Aircraft Mix. The capacity of a runway is dependent on the type and size of the aircraft that utilize the facility. Aircraft are categorized into four classes: Classes A and B consist of small single engine and twin-engine aircraft (both prop and jet), weighing 12,500 pounds or less, which are representative of the general aviation fleet. Class C and D aircraft are large jet and propeller aircraft typical of those utilized by the airline industry

and the military. Aircraft mix is defined as the relative percentage of operations conducted by each of these four classes of aircraft. In consideration of the forecasts presented in the previous chapter, an aircraft mix table has been generated. The following table, entitled *AIRCRAFT CLASS MIX FORECAST, 2000-2021,* presents the projected operational mix for the selected forecasts.

Table C3
AIRCRAFT CLASS MIX FORECAST, 2000-2021
Paine Field Master Plan Update

	VFR Conditions			IFR Conditions		
Year	**Class A & B**	**Class C**	**Class D**	**Class A & B**	**Class C**	**Class D**
2000 (1)	93.4%	5.0%	1.6%	80.0%	13.0%	7.0%
2006	90.0%	7.5%	2.5%	80.0%	13.0%	7.0%
2011	90.0%	7.5%	2.5%	80.0%	13.0%	7.0%
2016	90.0%	7.5%	2.5%	80.0%	13.0%	7.0%
2021	90.0%	7.5%	2.5%	80.0%	13.0%	7.0%

Class A - Small Single Engine, < 12,500 pounds
Class B - Small Twin-Engine, < 12,500 pounds
Class C - 12,500 - 300,000 pounds
Class D - > 300,000 pounds
(1) Existing percentage breakdown was estimated by Barnard Dunkelberg & Company (BD&Co.)

Percent Arrivals. Runway capacity is also significantly influenced by the percentage of all operations that are arrivals. Because aircraft on final approach are typically given absolute priority over departures, higher percentages of arrivals during peak periods of operations reduce the Annual Service Volume (ASV). The operations mix occurring on the runway system at Paine Field reflects a general balance of arrivals to departures; therefore, it was assumed in the capacity calculations that arrivals equal departures during the peak period.

Touch-And-Go Operations. A touch-and-go operation refers to an aircraft maneuver in which the aircraft performs a normal landing touchdown followed by an immediate takeoff, without stopping or taxiing clear of the runway. These operations are normally associated with training activity and are included in local operations figures when reported by an air traffic control tower. According to FAA *Form 5010*, touch-and-go operations are estimated to represent 50% of the total annual operations being conducted at the airport. It is anticipated that the level of flight training will increase through the planning period; however, the airport will continue to be a center for both business related itinerant and general aviation operations. Therefore, the percentage of touch-and-go operations is expected to increase to 60% by the end of the planning

period. It should be noted that a high percentage of instrument operations occurring at the airport are conducting training flights during VFR weather conditions. Approximately 50%-70% of these instrument operations break off their final approach to a go-around "missed" approach, which are subsequently counted as an arrival and a departure by FAA air traffic control.

Runway Use. The use configuration of the runway system is defined by the number, location, and orientation of the active runway(s) and relates to the distribution and frequency of aircraft operations to those facilities. Both the prevailing winds in the region and the existing runway facility at Paine Field combine to dictate the utilization of the existing runway system. According to airport management observations, Runway 16R/34L is the primary use runway. It is estimated that approximately 53% (50% 16R, 50% 34L) of the airport's operations are conducted utilizing this runway, while 43% (50% 16L, 50% 34R) of the airport's operations are conducted on Runway 16L/34R, and the remaining 4% (75% 29, 25% 11) of the airport's operations are conducted on Runway 11/29. Additionally, it is of interest to note that Runway 16R/34L operates (is open) on a 24 hour basis while Runways 16L/34R and 11/29 are designated VFR runways operating (are open) only from 7 a.m. to 9 p.m., when the FAA airport Air Traffic Control Tower is open.

Exit Taxiways. The capacity of a runway system is greatly influenced by the ability of an aircraft to exit the runway as quickly and safely as possible. Therefore, the quantity and design of the exit taxiways can directly influence aircraft runway occupancy time and the capacity of the runway system.

Due to the location of the existing exit taxiways serving the runway system at Paine Field, the number of available exit taxiways for use in the capacity calculation is adequate. Based upon the mix index of aircraft operating at the airport under VFR conditions, the capacity analysis, as described in the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, gives credit to only those runway exit taxiways located between 3,000 and 5,500 feet from the landing threshold. Therefore, landings to Runway 16R and Runway 34L each received an exit rating of two, with four being the maximum and no credit given for an exit within 750 feet of another exit. Runway 16L/34R and Runway 11/29, which primarily serve small aircraft, each receive an exit rating of one or two. It does not appear that the runway system would benefit from the construction of additional taxiways. However, the future location of all taxiway improvements (if any) will be evaluated in conjunction with the formulation of airside development alternatives.

Air Traffic Control Rules

The FAA specifies separation criteria and operational procedures for aircraft in the vicinity of an airport contingent upon aircraft size, availability of radar, sequencing of operations and noise abatement procedures, both advisory and/or regulatory, which may be in effect at the airport. The impact of air traffic control on runway capacity is most influenced by aircraft separation requirements dictated by the mix of aircraft utilizing the airport. Presently, there are no special air traffic control rules in effect at Paine Field that significantly impact operational capacity; however, it should be noted that when operating on the crosswind runway (Runway 11/29) there is currently a Land and Hold Short Operation (LAHSO) procedure, which is inclusive of the appropriate markings, lighting, and signage. It should be noted the Paine Field Air Traffic Control Tower does not operate on a twenty-four hour schedule.

Peak Period Operations

An additional element of assessing airport usage and determining various requirements necessitated by capacity and demand considerations is the determination of peak period activities. Actual ATCT records for 2000, along with statistics regarding operations at airports with similar activity and operational characteristics, have been utilized to formulate peak period forecasts. The projection of peak period operational activity is depicted in the following table, entitled *PEAK PERIOD AIRCRAFT OPERATIONS, 2000-2021*. The Peak Month Aircraft Operations in 2000 was determined by an examination of air traffic control tower records and that percentage has been used to estimate peak month operations throughout the planning period. The Average Day of the Peak Month was estimated by dividing the peak month operations by 31. Peak Hour/Average Day Ratio was established by examining operations at other airports with similar activity and operational characteristics, as well as utilizing typical ratios provided in FAA AC 150/5070-6A, *Airport Master Plans*. While peak period, as previously mentioned, is an average, and due to the geography of Paine Field - exhibiting bursts of good weather followed by bursts of bad weather, it is of interest to note that Paine Field recently experienced peak hours of 120 operations.

Table C4
PEAK PERIOD AIRCRAFT OPERATIONS, 2000-2021
Paine Field Master Plan Update

Year	Annual Aircraft Operations	Peak Month Aircraft Operations	Average Day of Peak Month	Peak Hour/ Average Day Ratio	Average Peak Hour Aircraft Operations
2000	213,291	21,329	688	9.0%	62
2006	290,235	29,024	936	8.5%	80
2011	310,980	31,098	1,003	8.3%	83
2016	334,204	33,420	1,078	8.0%	86
2021	359,176	35,918	1,159	7.8%	90

Source: BD&Co. Forecast Based on Methodology From FAA AC 150/5070-6A, *Airport Master Plans* and FAA AC 150/5060-5, *Airport Capacity and Delay*.

Airfield Capacity Analysis

As previously described, determination of capacity figures for Paine Field will utilize the throughput method of calculation, described in the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*. These formulae, applying information generated from preceding analyses, illustrate capacity and demand in terms of the following results:

- Hourly Capacity of Runways
- Annual Service Volume (ASV)

The following capacity computations provide assistance in evaluating the ability of the existing airport facilities, both airside and landside, to accommodate forecast demand.

Hourly Runway Capacity

Calculations of hourly runway capacity begin with an evaluation of each possible runway-use configuration at the airport. With consideration of the airport's aircraft mix index, annual percentage of touch-and-go operations, existing IFR operating conditions and taxiway exit rating, an hourly capacity was calculated. For all runway use configurations, the airport's average VFR hourly capacity was determined to be approximately 202 operations, which compares to an IFR hourly capacity of approximately 78 operations.

Annual Service Volume

After determining the hourly capacity for each potential runway use configuration, a weighted hourly capacity of the entire airport can be calculated. The weighted hourly capacity takes into consideration not only the aircraft mix index, but also the percent utilization of each possible runway use configuration. The weighted hourly capacity for Paine Field for 2000 was determined to be approximately 92 operations per hour. This weighted hourly capacity can then be used in calculating the ASV for the airport. The ASV is calculated using the following formula:

$$ASV = C_W \times D \times H$$

- C_W weighted hourly capacity
- D ratio of annual demand to average daily demand
- H ratio of average daily demand to average peak hour demand

In consideration of the existing runway configuration, runway utilization patterns and 2000 operation counts (i.e., 213,291), Paine Field has been determined to have a daily demand ratio (D) of 310 operations and an hourly demand ratio (H) of 11.1 operations, and thus, an ASV of approximately 316,218 operations.

Conditions that are involved with the determination of the weighted hourly capacity and the daily demand are not forecast to change significantly in the future, and those numbers will remain fairly constant through the planning period. The hourly ratio, as specified in the formula, is the inverse of the daily operations that occur during the peak hour. In other words, as operations increase, the peak periods tend to spread out, increasing the hourly ratio (H). As the hourly ratio increases, the ASV will increase. Capacity information contained in the previous 1995 MP indicated that a Paine Field runway configuration accommodates an ASV of 305,000 annual operations. However, general planning guidelines suggest that the ASV for Paine Field could be as much as 367,000 annual operations per year. Based on the aircraft fleet mix currently utilizing Paine Field, this ASV seems appropriate through the planning period.

Table C5
AIRFIELD CAPACITY FORECAST SUMMARY, 2000-2021
Paine Field Master Plan Update

Year	Annual Operations	Design Hour Operations	Annual Service Volume (ASV)
2000	213,291 (1)	62	316,000
2006	290,235	80	333,000
2011	310,980	83	344,000
2016	334,204	86	351,000
2021	359,176	90	367,000

(1) Actual operations count for the airport.

Ground Access Capacity

The capacity of the landside access system is a function of the maximum number of vehicles that can be accommodated by a particular ground access facility. Therefore, the focus of the roadway capacity assessment is on the service provided between the various airport facilities and the regional highway system (SR 526 and Interstate 5). Because Paine Field is located within a densely populated area, the existing airport access roadway system is impacted not only by the direct users of the airport, but also by the background traffic associated with the surrounding residential, commercial, and industrial development in the vicinity of the airport.

The capacity of roadways providing access to the airport is based on the *Highway Capacity Manual,* published by the Transportation Research Board, Special Report 209, 1985. It is normally preferred that a roadway operate below capacity to provide reasonable flow and minimize delay to the vehicles using it. The *Highway Capacity Manual* defines different operating conditions, known as levels-of-service. The levels-of-service are functions of the volume and composition of the traffic and the speeds attained. Six levels-of-service have been established, designated by the letters A-F, providing for best to worst service in terms of driver satisfaction. Level-of-service F defines a road operating beyond its maximum capacity; traffic is typically almost at a standstill causing major delays to road users. Level-of-service A is defined as a road with free flow operational characteristics at average travel speeds. Vehicles on a level-of-service A roadway are completely unimpeded in their ability to maneuver within the traffic stream. A level-of-service C, represented by stable traffic flow and minimal delays, is generally the preferred level of service on a road system such as in the vicinity of Paine Field. Average hourly volumes

of airport service roadways of typical facilities at level-of-service C and D are summarized in the following table.

Table C6
GROUND ACCESS FACILITY VOLUME
Paine Field Master Plan Update

Facility Type	Average Hourly Volume [1] (Vehicle/Hour/Lane) [2]
Main-access and feeder freeways (controlled access, no signalization)	1,000-1,600
Ramp to and from main-access freeways, single lane	900-1,200
Principal arterial (some cross streets, two-way traffic)	900-1,600
Main-access road (signalized intersections)	700-1,000
Service road	600-1,200

Source: Measuring Airport Landside Capacity, Transportation Research Board, 1987
[1] Highway level-of-service C and D
[2] Passenger-car equivalents

It should be noted that the roadway capacity analysis for Paine Field takes into consideration the forecast of passenger enplanements and aviation activity. The roadway capacity analysis does not take into consideration additional traffic demands that might be generated by new industrial or commercial activity on the airport. The effects of any new industrial/commercial demand cannot be analyzed until employment numbers are quantified; therefore, as a part of the feasibility analysis for any new major employer on the airport, the impact on the landside access system must be considered.

The major roadways associated with Paine Field include: Airport Road, Holly Drive, 100th St. S.W., 112th St. S.W., SR 99 (Pacific Highway), Beverly Park Road, SR 525 (Mukilteo Speedway), 121st St. S.W., and Minuteman Drive.

- Airport Road is currently classified as an arterial roadway operated as a seven-lane facility north of 100th St. S.W. and six lanes south of 100th St. S.W., including two peak hour HOV (High Occupancy Vehicle) lanes. Airport Road runs northwest to southeast, between SR 526 and 128th St. S.W. While it is a major access route into the Boeing Plant and carries a large volume of the peak hour Boeing trips, it does provide access

to the non-Boeing portions of the Paine Field property, as well as other industrial and commercial businesses along the route.

- Holly Drive is a two-lane collector arterial roadway, which is an extension of Beverly Park Road and extends to the northeast.
- 100th St. S.W. provides a link between the commercial area around Evergreen Way and Airport Road. It also provides one of the main access points into Paine Field. This road has two lanes and has curbs, gutters, and sidewalks about 1/3 of its length.
- 112th St. S.W. is a two-lane minor arterial providing a link between Beverly Park Road and SR 527 in the Silver Lake Area, east of I-5. Snohomish County plans to widen this portion of the street to five lanes including bike lanes, curb, gutter, and sidewalk.
- SR 99 (Evergreen Way) is a state route running between Northern Pierce County, through King County and into Everett. This highway also provides connections to other regional and state routes, which include I-5, SR 525, and SR 526. SR 99 has been classified as a principal arterial. The basic cross section is five (5) lanes with intermittent sidewalks. The City of Everett plans to improve SR 99 between 112th St. S.W. and Airport Road. The improvement will widen SR 99 to provide three lanes in each direction.
- Beverly Park Road is classified as a collector arterial and connects 52nd Ave. W to SR 525 and Holly Drive. A portion of the network abuts the city of Mukilteo, which includes two lanes, one shoulder, and no sidewalks. There is a narrow pedestrian and bicycle pathway separated from the shoulder in the vicinity of Fairmount Elementary School. Bike lanes along this route are provided southwest of the SR525 intersection. Snohomish County has plans to improve this road to five lanes with curbs and sidewalks in 2004/05.
- SR 525 (Mukilteo Speedway) connects the I-5/I-405 interchange to the Mukilteo Ferry Terminal. It is classified as a two-lane principal arterial; however, a WSDOT project to widen this roadway to four lanes began in early 2001 and will continue for two years.
- 121st S.W., classified as a collector arterial, connects Beverly Park Road to SR 525. The City of Mukilteo plans to improve this street by realigning 121st St. S.W. to create a four-leg intersection with Harbour Pointe Boulevard and SR 525.
- Minuteman Drive is currently a two-lane internal Snohomish County/Paine Field roadway providing access into the airport's industrial park and hangar areas. Minuteman Drive is an extension of 106th St. S.W.; however, it is not a dedicated public right-of-way. This roadway will be widened to three lanes with curbs and a sidewalk in 2001.

Based on the adopted forecast, peak hour trips into and out of the airport on the west leg of Airport Road/100th Street S.W. intersection, due to passenger activity, will represent an insignificant increase in the overall traffic volumes. While the airport

entrance roadway is adequate to accommodate this increase, traffic entering and leaving the airport will be affected by the level-of-service at the Airport Road/100th Street S.W. intersection, which will likely operate in the level-of-service D or E range during the system peak hour. Currently, The Boeing Co. shift change creates a peak period hour between the hours of 2:30 p.m. and 4:00 p.m.

On Airport Road, north of the intersection with 100th St. S.W., the increase in traffic due to forecast passenger activity at Paine Field as a percentage of projected background traffic will be, as previously mentioned, a very insignificant amount of the total traffic traversing this roadway.

According to Snohomish County Public Works, Airport Road was recently reconstructed to create a seven-lane section with a center turn lane, two through lanes, and a peak hour HOV lane in each direction. This improvement also included the addition of bike lanes, curbs, gutters, and sidewalks on both sides of the road. In terms of traffic volume relative to roadway capacity, the ultimate configuration of Airport Road should be adequate.

A transportation study for a new Airport Road Transfer Station (ARTS), published by W&H Pacific, February 23, 2001, states that the new ARTS would create minimal impacts on the operation of the street network. The proposed facility is located on the southeast corner of Paine Field, adjacent to Airport Road, and will be accessed by driveways off Minuteman Drive. As part of the study, ten street networks were identified in the project. Current levels-of-service for these street segments range from B, good, to F, total failure. Total failure exists at Beverly Park Road/SR 525 during the weekday a.m. and the p.m., at Airport Road/SR 99 during the p.m., which coexists with the Boeing Plant shift change between 2:00 p.m. and 4:00 p.m. and the weekends, and at SR 99/112th Street S.W. on the weekends. According to Snohomish County Code, Title 26B, new developments must meet requirements to mitigate impacts on the transportation system. Currently, there are a number of projects on the books, which are committed to by the county to bring the new facility into compliance: Beverly Park Road from Airport Road to SR 525, 112th St. S.W. from SR 99 to 3rd Ave. W., Airport Road from SR 99 to 94th, 112th St. S.W. from Beverly Park to Airport Road. These improvements will provide levels-of-service of E or better.

Capacity Summary

This section has analyzed the capacity of existing facilities at Paine Field. Both adequate airfield and ground access facilities are critical components in the ability of the airport as a whole to efficiently serve the public. Capacity deficiencies that cause delays associated within one area will often be reflected in the ability or inability of the entire facility to function properly.

The following Facility Requirements section will delineate the various facilities required to properly accommodate future demand. That information, in addition to the capacity analysis, will provide the basis for formulating the alternative development scenarios for the airport and will ensure that the new recommended development plan can adequately accommodate the long-term aviation development requirements.

Facility Requirements

In efforts to identify future demand at the airport for those facilities required to adequately serve future needs, it is necessary to translate the forecast aviation activity into specific types and quantities. This section addresses the actual physical facilities and/or improvements to existing facilities needed to safely and efficiently accommodate the projected demand that will be placed on the airport. This section consists of two separate analyses: those requirements dealing with *airside* facilities and those dealing with *landside* facilities.

Airfield Requirements

The analysis of airfield requirements focuses on the determination of needed facilities and spatial considerations related to the actual operation of aircraft on the airport. This evaluation includes the delineation of airfield dimensional criteria, the establishment of design parameters for the runway and taxiway system, and an identification of airfield instrumentation and lighting needs.

Airfield Dimensional Criteria

The types of aircraft that currently operate at Paine Field and those that are projected to utilize the facility in the future have an impact on the planning and design of airport facilities. This knowledge assists in the selection of FAA specified design standards for the airport, which include runway/taxiway dimensional requirements; runway length; and runway, taxiway, and apron strength. These standards apply to the "Design Aircraft", which either currently utilizes the airport or which is projected to utilize the airport in the future. Certain areas at the airport are intended for use by large and small aircraft (e.g., Runway 16R/34L and supporting taxiway system, the Boeing Company Ramp, the Terminal Ramp, and Goodrich Inc.), while other areas are intended for use by small aircraft only (Runway 16L/34R and Runway 11/29, along with their supporting taxiway systems and general aviation ramps).

Because various areas on the airport are intended for use by aircraft with widely varying physical and operational characteristics, they can be designed with different criteria. The portion of the airport that is utilized by large and small aircraft accommodates a substantial number of large transport jet aircraft. These large transport aircraft operations are primarily related to Boeing Company and Goodrich Inc. manufacturing and maintenance activities at Paine Field. The largest aircraft that currently utilizes Paine Field on a regular basis (more than 500 landings or takeoffs per year) is the B-747-400. The B-747-400 sets the parameter for wingspan and approach speed, with a wingspan of 213 feet and an approach speed of 154 knots. The areas on the airport which are only utilized by smaller aircraft (Runway 16L/34R and Runway 11/29) accommodate primarily general aviation aircraft under 12,500 pounds, with approach speeds less than 121 knots, and wingspans less than 49 feet (e.g., the Beech King Air B100).

According to FAA Advisory Circular 150/5300-13, *Airport Design*, the first step in defining an airport's design geometry is to determine its Airport Reference Code (ARC). An airport that accommodates aircraft with an approach speed as great as 141 knots, but less than 166 knots and with wingspans as great as 171 feet, but less than 214 feet, should be designed utilizing ARC D-V dimensional criteria, and those aircraft with an approach speed as great as 91 knots, but less than 121 knots and with wingspans up to 49 feet, should be designated utilizing ARC B-1 criteria. The previously mentioned aircraft is the Design Aircraft for dimensional criteria only (i.e., runway/taxiway separation, runway/taxiway safety areas, aircraft parking separation, etc.), and is not intended to be used to dictate runway length requirements, although it may be used as a guide in the process of determining runway length. Additionally, if the development of Boeing's B-747X aircraft comes to fruition, it would be classified with an ARC of D-VI. However, the new aircraft would likely produce less than 500 operations per year (FAA threshold for design criteria).

The dimensional criteria illustrated in the following tables, entitled *ARC D-V DIMENSIONAL STANDARDS FOR RUNWAY 16R/34L (In Feet)* and *ARC B-I (small aircraft only) DIMENSIONAL STANDARDS FOR RUNWAYS 16L/34R AND 11/29 (In Feet)* are dimensions required for those portions of the airport utilized by both large and small aircraft.

Table C7
ARC D-V DIMENSIONAL STANDARDS FOR RUNWAY 16R/34L (in Feet)
Paine Field Master Plan Update

Item	Approach Visibility Minimums Lower Than ¾ - Statute Mile[1]	Existing Dimension
Runway Width	150	150
Runway Centerline to Taxiway Centerline	400	540
Runway Centerline to A/C Parking	500	500+
Runway Centerline to BRL	---	745
Runway Centerline to Holdline	286	286
Runway Safety Area Width	500	500
Runway Safety Area Length Beyond Runway End		
Runway 16R	1,000	1,000
Runway 34L	1,000	1,000
Runway Object Free Area Width	800	800
Runway Object Free Area Length Beyond Runway End		
Runway 16R	1,000	1,000
Runway 34L	1,000	1,000
Runway Blast Pad Width		
Runway 16R	220	220
Runway 34L	220	220
Runway Blast Pad Length		
Runway 16R	400	400
Runway 34L	400	400
Runway Shoulder Width	35	35

Source: AC 150/5300-13, Federal Aviation Administration.
Runway Safety Area (SA): An area adjacent to the runway, which is capable of supporting the occasional passage of aircraft without causing structural damage under dry conditions.
Runway Object Free Area (OFA): A two dimensional ground area centered on the runway centerline which is clear of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.
Building Restriction Line (BRL): The BRL encompasses the runway protection zones (RPZ), the runway object free area, the runway visibility zone, NAVAID critical areas, areas required for terminal instrument procedures, and areas required for airport traffic control tower clear line of sight.
Bold type dimensions reflect a deficiency in standards.
[1] Existing airport approach visibility minimums is ½ statute mile.

Table C7 (Continued)
ARC D-V DIMENSIONAL STANDARDS FOR RUNWAY 16R/34L (in Feet)
Paine Field Master Plan Update

Item	Approach Visibility Minimums Lower Than ¾ - Statute Mile[1]	Existing Dimension
Taxiway Shoulder Width	35	35
Taxiway Width		
Taxiway Alpha	75	75
Taxiway Alpha-A	75	100
Taxiway Alpha-1	75	100
Taxiway Alpha-2	75	**50**
Taxiway Alpha-3	75	**50**
Taxiway Alpha-4	75	75
Taxiway Alpha-5	75	150
Taxiway Alpha-6	75	100
Taxiway Alpha-7	75	75
Taxiway Alpha-8	75	100
Taxiway Alpha-9	75	100
Taxiway Safety Area Width	214	214
Taxiway Object Free Area Width	320	320

Source: AC 150/5300-13, Federal Aviation Administration.
Bold type dimensions reflect a deficiency in standards.
[1] Existing airport approach visibility minimums is ½ statute mile.

Table C8
ARC B-I (Small Aircraft Only) DIMENSIONAL STANDARDS FOR RUNWAY 16L/34R and 11/29 (in Feet)
Paine Field Master Plan Update

Item	Approach Visibility Minimums Not Lower Than ¾ - Statute Mile[1]	Existing Dimension
Runway Width		
Runway 16L/34R	60	75
Runway 11/29	60	75
Runway Centerline to Taxiway Centerline		
Runway 16L/34R	150	150
Runway 11/29	150	150
Runway Centerline to A/C Parking		
Runway 16L/34R	125	250
Runway 11/29	125	250
Runway Centerline to BRL		
Runway 16L/34R	---	200
Runway 11/29	---	200
Runway Safety Area Width	120	120
Runway Safety Area Length Beyond Runway End		
Runway 16L	240	240
Runway 34R	240	240
Runway 11	240	240
Runway 29	240	240
Runway Object Free Area Width	250	250
Runway Object Free Area Length Beyond Runway End		
Runway 16L	240	240
Runway 34R	240	240
Runway 11	240	240
Runway 29	240	240

Source: AC 150/5300-13, Federal Aviation Administration.
Runway Safety Area (SA): An area adjacent to the runway, which is capable of supporting the occasional passage of aircraft without causing structural damage under dry conditions.
Runway Object Free Area (OFA): A two dimensional ground area centered on the runway centerline, which is clear of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.
Building Restriction Line (BRL): The BRL encompasses the runway protection zones (RPZ), the runway object free area, the runway visibility zone, NAVAID critical areas, areas required for terminal instrument procedures, and areas required for airport traffic control tower clear line of sight.
[1] Existing runway approach visibility minimums.

Table C8 (Continued)
ARC B-I (Small Aircraft Only) DIMENSIONAL STANDARDS FOR RUNWAY 16L/34R and 11/29 (in Feet)
Paine Field Master Plan Update

Item	Approach Visibility Minimums Not Lower Than ½ - Statute Mile[1]	Existing Dimension
Runway Blast Pad Width	80	N.D.
Runway Blast Pad Length	60	N.D.
Runway Shoulder Width	10	N.D.
Taxiway Width		
Taxiway Charlie	25	40
Taxiway Delta	25	40
Taxiway Foxtrot	25	40
Taxiway Golf	25	40
Taxiway Safety Area Width	49	49
Taxiway Object Free Area Width	89	89

Source: AC 150/5300-13, Federal Aviation Administration.
[1] Existing airport approach visibility minimums.
N.D. – Not Designated.

As can be seen in the above tables, the runway/taxiway facilities at Paine Field are in compliance with a majority of the FAA specified dimensional criteria for the runway's existing approach visibility minimums, and for the lower than ¾-mile visibility minimums.

Runways

In consideration of the forecasts of future aviation activity, the adequacy of the runway system must be analyzed from several perspectives. These include runway orientation and airfield capacity, which were analyzed in the previous section, as well as runway length, pavement strength and runway visibility, which will be evaluated in the following text. The analysis of these various aspects pertaining to the runway system will provide a basis for recommendations of future improvements.

Runway Orientation. Paine Field currently operates with three runways, the primary Runway 16R/34L, the secondary Runway 16L/34R, and the crosswind Runway 11/29. As presented in a previous section, the existing runway configuration provides excellent wind coverage (i.e., 100%) for the 20- and 10.5-knot crosswind components; therefore, no additional runways are required from a *wind coverage* standpoint.

Airfield Capacity. The evaluation of airfield capacity, as presented in previous sections, indicates that the airport will not exceed the capacity of the existing runway/taxiway system before the end of the planning period.

Under existing operating conditions, the airport's Annual Service Volume (ASV) for the year 2021 was projected to be 367,000 operations. FAA planning standards indicate that when 60% of the ASV is reached (i.e., 220,200 operations), the airport should start planning ways to increase capacity and when 80% of ASV is reached (293,600 operations), construction of facilities to increase capacity should be initiated. These conditions should be monitored as *trends* and not just as one-time occurrences. This trend monitoring will provide lead-time in recognizing demand for facilities before the need occurs and will help to keep expenditures within budgetary constraints.

During 2000, aircraft operations at Paine Field totaled 213,291, which is below the 60% level of the ASV. In addition, 359,176 annual operations are forecast to occur at the airport by the end of the planning period, which is above the 60% level of the ASV. If regional passenger service is implemented at Paine Field, the forecasts indicate the airport could surpass 80% of its capacity by the end of the 20-year planning period.

Even before an airfield reaches capacity, it begins to experience certain amounts of delay in aircraft operations. As an airport's operations increase toward capacity, delay increases exponentially. These estimates of the annual service volume indicate that the airport will be approaching its capacity to accept aircraft operations if the forecasts of aviation activity are achieved. As stated previously, it should be kept in mind that these are only general estimates and, specific conditions (particularly those related to air traffic control, aircraft fleet mix, and approach capabilities) can significantly lower or raise an airport's ability to accept aircraft traffic. It appears that the physical layout of Paine Field has adequate capacity to accommodate the forecast number of aircraft operations; however, there is a potential for some capacity and delay problems in the future. The airport's development program will strive to maximize the airport's ability to accept aircraft operations within the constraints of its existing physical runway layout.

Runway Length. The determination of runway length requirements for Paine Field is based on several factors. These factors include:

- Airport elevation;
- Mean maximum daily temperature of the hottest month;
- Runway gradient;

- Critical aircraft type expected to use the airport; and,
- Stage length of the longest nonstop trip destination.

The runway length operational requirements for aircraft are greatly affected by elevation, temperature and runway gradient. The calculations for runway length requirements at Paine Field are based on an elevation of 609.65 feet AMSL, 73.0 degrees Fahrenheit NMT (Mean Normal Maximum Temperature), and a maximum difference in runway elevation at the centerline of 15 feet.

As can be seen in the following table, entitled *RUNWAY TAKE-OFF LENGTH REQUIREMENTS*, there are four runway lengths shown for small aircraft type runways (runways intended for use primarily by aircraft under 12,500 pounds). Each of these provides the proper length to accommodate a certain type of aircraft that will utilize the runway. The lengths range from 2,520 to 3,640 feet, while the runway length for small aircraft seating more than ten passengers is 4,090 feet.

There are four different lengths given for large aircraft under 60,000 pounds. The specified large aircraft runway lengths pertain to those general aviation aircraft, generally jet-powered, of 60,000 pounds or less maximum certificated take-off weight. The requirements of the large aircraft fleet range from 4,770 to 7,430 feet in length for the runway at Paine Field. Each of these lengths provides a runway sufficient to satisfy the operational requirements of a certain percentage of the fleet at a certain percentage of the useful load, (i.e., 75 percent of the fleet at 60 percent useful load). The useful load of an aircraft is defined as the difference between the maximum allowable structural gross weight and the operating weight empty. In other words, it is the load that can be carried by the aircraft composed of passengers, fuel, and cargo. Generally speaking, the following aircraft comprise seventy-five percent of the large aircraft fleet weighing less than 60,000 pounds: Learjets, Sabreliners, Gulfstreams, Citations, Falcons, Hawkers, and Westwinds.

The last row in the table refers to the critical large transport aircraft, the B-747-400 and the B-777-200/300. These calculations were obtained from Airplane Characteristics for Airport Planning, Boeing Commercial Airplane Group. Heavy gross weight take-offs are routinely programmed for these aircraft with delivery flights to all areas of the World - the Pacific Rim, Europe, Australia, South America, and Asia - from the Everett Boeing Plant.

Table C9
RUNWAY TAKE-OFF LENGTH REQUIREMENTS
Paine Field Master Plan Update

Runway Requirement	Runway Take-off Length (Feet) Dry Pavement	Runway Take-off Length (Feet) Wet Pavement
Small Aircraft with less than 10 seats		
75% of Small Aircraft	2,520	2,520
95% of Small Aircraft	3,040	3,040
100% of Small Aircraft	3,640	3,640
Small Aircraft with more than 10 seats	4,090	4,090
Large Aircraft less than 60,000 pounds		
75% of fleet/60% useful load	4,770	5,320
100% of fleet/60% useful load	6,030	6,760
75% of fleet/90% useful load	5,180	5,500
100% of fleet/90% useful load	7,430	7,430
Large Aircraft greater than 60,000 pounds		
B-747-400[2]	9,300	9,300[1]
B-777-200[3]	7,200	7,200[1]
B-777-300[4]	9,050	9,050[1]

Source: Runway Lengths Based on 606' AMSL, 73.0°F NMT and Maximum difference in runway end of 15 feet.
[1] Runway length calculations do not differentiate between dry and wet pavement conditions.
[2] 747-400 Airplane Characteristics for Airport Planning, Boeing Commercial Airplane Group, October 1994. Based on take-off runway length requirement – standard day + 27° F, CF6-80C2b1F engines (57,900 pounds thrust), a brake-release gross weight of 800,000 pounds, and an airport elevation of 606'.
[3] 777-200 (Baseline Model) Airplane Characteristics for Airport Planning, Boeing Commercial Airplane Group, May 1995. Based on take-off runway length requirement – standard day + 27° F, GE90-B3/-B4 engines (74,500 pounds thrust), a brake-release gross weight of 506,000 pounds, and an airport elevation of 606'.
[4] 777-300 (Baseline Model) Airplane Characteristics for Airport Planning, Boeing Commercial Airplane Group, August 1996. Based on take-off runway length requirement – standard day + 27° F, GE90-92B engines (90,000 pounds thrust), a brake-release gross weight of 580,000 pounds, and an airport elevation of 606'.

An important factor to note when considering the generalized large aircraft runway take-off length requirements presented in the table above is that the actual length necessary for a runway is a function of elevation, temperature, and aircraft stage length. As temperatures change on a daily basis, the runway length requirements change accordingly. The cooler the temperature, the shorter the runway necessary; therefore, for example, if an airport is designed to accommodate 75% of the fleet at 90% useful load, this does not mean that at certain times a larger business jet cannot use the airport or that aircraft cannot use it with heavier loadings than that represented by 90% of the maximum useful load.

According to the previous table, the length of the airport's primary runway is more than adequate to accommodate 100% of the large general aviation aircraft fleet at 90% useful load. However, the current runway length of 9,010 is 290 feet short in accommodating the fully loaded B-747-400 and 40 feet short of accommodating a fully loaded B-777-300. A delivery flight of these aircraft will infrequently require a longer runway than is provided at Paine Field and will subsequently have to utilize Boeing Field. As described by the Boeing Company and Goodrich Inc., any reduction in runway length will have an adverse effect on the aircraft's operational capabilities when operating at a maximum weight for delivery purposes.

These runway length requirements considered as a whole indicate that the runway length presently provided by Runway 16R/34L is adequate to accommodate the existing and forecast aircraft fleet under most operating conditions, thus a runway extension is not recommended. In consideration of the runway lengths provided by the general aviation runways at the airport, Runway 16L/34R can accommodate 95% of the small aircraft fleet with ten seats or less and Runway 11/29 can accommodate 100% of the small aircraft fleet including those with ten or more seats.

With this information as background, no runway extension projects are proposed for any of the runways at Paine Field.

Runway Pavement Strength. As identified in the *INVENTORY OF EXISTING CONDITIONS* chapter of this document, Runway 16R/34L is rated in good condition, with an existing gross weight bearing capacity of 100,000 pounds for single-wheel, 200,000 pounds for dual-wheel, 350,000 pounds for dual tandem-wheel, 722,000 pounds for dual tridem, and 830,000 pounds for double dual tandem-wheel main landing gear configuration aircraft. Runway 16L/34R is rated in good condition, with an existing gross weight bearing capacity of 12,500 for single-wheel main landing gear configuration aircraft. Runway 11/29 is also rated in good condition with an existing weight bearing capacity of 40,000-50,000 pounds for single-wheel and 55,000-75,000 pounds for dual-wheel main landing gear configuration aircraft. According to the existing and projected operational fleet mix, this pavement strength is adequate to accommodate both the commercial service aircraft and business jet fleet.

Assuming proper maintenance, these estimated design runway pavement strengths are adequate to accommodate present and forecast utilization (including infrequent use of Runway 16R/34L by aircraft up to 830,000 pounds). This does not take into consideration pavement rehabilitation or overlay projects required for upkeep and maintenance. Recently, the FAA funded a study, through the Washington State Department of Transportation (WSDOT), on airfield pavement within the state, including Paine Field. The report, produced by Pavement Consultants Inc., April 10, 2001, identified a large need for pavement maintenance on a recurrent basis. The report quantifies specific areas of the airport according to a pavement condition index (PCI).

Using each of the sections assigned a PCI, a pavement condition rating was assigned (PCR). This PCI index can range from a low of 0 to a high of 100 and the PCR can range from poor to excellent. Paine Field was found to have an overall average PCI of 77 and a PCR of very good for all pavements. Some of the primary distresses observed during the inspection include alligator cracking, block cracking, joint reflection cracking, swelling, joint seal damage, linear cracking, and corner spalling.

Runway Line of Sight. According to existing runway line-of-sight standards, any two points located five feet above the runway centerline must be mutually visible for the entire length of the runway. If the runway has a full-length parallel taxiway, the visibility requirement is reduced to a distance of one-half the runway length. While Paine Field does comply with the runway line-of-sight standards, due to the existence of Taxiway "Alpha", Runway 16R/34L demonstrates somewhat of an undulating profile, which can confuse automatic landing systems on some aircraft.

Taxiways

Taxiways are constructed primarily to enable the movement of aircraft between the various functional areas on the airport and the runway system. Some taxiways are necessary simply to provide access between aircraft parking aprons and runways, whereas other taxiways become necessary to provide more efficient and safer use of the airfield. As described earlier, the taxiway system at Paine Field generally meets the required standards.

Runway 16R/34L is served by a full-length parallel taxiway (Taxiway A) on its east side. This parallel taxiway is served by eleven easterly taxiway exits (including the intersection with Runway 11/29), as well as two westerly taxiway exits. The majority of Taxiway A has a runway centerline separation of 540 feet, with the northern end angling in toward the runway. At the threshold of Runway 16R, the separation between the runway centerline and the centerline of Taxiway A is 425 feet.

The crosswind runway, Runway 11/29, is equipped with a full-length parallel taxiway, Taxiway D, located on the northeast side of the runway. A partial parallel taxiway, Taxiway C, located on the northeast side of Taxiway D, extends 2,200 feet from the intersection of Taxiway A to the Central Ramp. Runway 11/29 is served with six northeasterly taxiway exits, as well as one southwesterly taxiway exit. There is a runway centerline separation of approximately 150 feet. The secondary parallel runway, Runway 16L/34R, is served by two full-length parallel taxiways, Taxiway F, on the east side, and Taxiway G, on the west side. Taxiway F is served with five taxiway exits and Taxiway G is served with six taxiway exits. Both taxiways are separated by 150 feet of centerline distance.

The taxiway system at Paine Field is well configured to provide good access between the runways and landside use areas (aprons, hangars, etc.). In addition, it is well configured to minimize runway occupancy times by providing properly located exit taxiways. Potential improvements will include providing access to new and/or expanded landside aviation use areas at the airport and a specific examination of the need for additional exit taxiways to improve the runway exit efficiency.

Development alternatives for the location of both additional exit taxiways and access taxiways are evaluated in the *CONCEPTS, ATERNATIVES AND DEVELOPMENT PLAN* chapter of this document. This evaluation will include providing access to the Goodrich Inc., Hangar 1 for aircraft as large as the B-747. Additionally, over the last ten years, the airport has improved the taxiway system by adding shoulders and removing obstructions within the object free area (OFA), as well as adding a perimeter roadway system to minimize the need for access of airport vehicles onto existing taxiways and/or shoulders.

Instrumentation and Lighting

Electronic landing aids, including instrument approach capabilities and associated equipment, airport lighting, and weather/airspace services, were detailed in the *INVENTORY OF EXISTING CONDITIONS* chapter of this document. The existing navigation aids at and around Paine Field include an ILS CAT I precision approach to Runway 16R, two non-precision approaches (NDB and GPS) to Runway 16R, one non-precision approach (GPS) to Runway 34L, and one circle-to-land approach (VOR or GPS-B).

Visual Landing Aids (lights). Presently, Runway 16R/34L at Paine Field is equipped with High Intensity Runway Lights (HIRL) edge lights and Runway Centerline Lights. The Runway 16R end is equipped with a Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) and a Precision Approach Path Indicator (PAPI) on the right side of the runway. Runway 34L is equipped with a Medium Intensity Approach Lighting System with Sequenced Flashers (MALSF) and a Precision Approach Path Indicator (PAPI) on the left side of the runway. Runways 16L/34R and 11/29 are both equipped with Medium Intensity Runway Lights (MIRL) edge lights. Runway 16R/34L is served with Runway End Identifier Lights (REILS) and Precision Approach Path Indicators (PAPI) on both ends, while Runway 11/29 is equipped with Vertical Approach Slope Indicator (VASI) lights on both ends. In conjunction with the examination of improved instrument approaches described above, improved airport lighting will also need to be evaluated. The type of airport lighting will be dependent on the type of instrument approach capabilities and will be examined in the next chapter.

Future Approaches. From the standpoint of wind direction during Instrument Meteorological Conditions, the existing straight-in approach capabilities to Runway 16R

provide good coverage. However, to provide operational flexibility the potential to implement a precision instrument approach to Runway 34L and improved non-precision approach capabilities to Runway 16R should be considered. For long-term considerations, the ability to install a CAT II/III Precision Approach serving Runway 16L is being protected.

In the past, the airport has been served by straight-in non-precision approach capabilities to Runway 34L. With the relocation of the airport's VOR in 1992, straight-in VOR approach capabilities have not been re-established to Runway 34L or to Runway 16R. The re-establishment of these VOR approaches should remain a priority. As previously mentioned, 50%-70% of instrument approaches to Runway 16R/34L "break" off or perform a go-around operation. If wind conditions at Paine Field warrant or dictate a need for aircraft operations to fly to the north, departing aircraft would be in a "head-to-head" conflict with aircraft, which need to utilize the precision approach, landing south. The airport's "Noise Abatement Program" recommends that large aircraft, when departing north, fly a runway heading to the coast before initializing a bank to the east or west. Currently, if two aircraft are in a "head-to-head" conflict, the departing aircraft must quickly turn. Thus, full power aircraft must traverse over the city of Mukilteo or Everett. A further analysis of implementing a precision approach to Runway 34L will be conducted in the following chapters.

One issue which arose during the formulation of the facility requirements in the 1995 MP, was the potential need for published helicopter approaches to points on the airport other than the existing runway system. As of 1999, the existing helipad was decommissioned and will not need further analysis in this MP Update.

Within the near future, Global Positioning System (GPS) approaches are expected to be the FAA's standard approach technology. With GPS, the cost of establishing improved instrument approaches should be significantly reduced. Because of the expected continued use of sophisticated general aviation, air carrier, and corporate aircraft at Paine Field, the ability to implement improved instrument approaches will be analyzed in the next chapter.

Runway Protection Zones (RPZs). The function of the RPZ is to enhance the protection of people and property on the ground off the end of runways. This is achieved through airport control of the property within the RPZ area. This control can be exercised through either fee-simple ownership or the purchase of RPZ easement. The RPZ is trapezoidal in shape and centered about the extended runway centerline. Its inner boundary begins 200 feet beyond the end of the area usable for take-off or landing. The dimensions of the RPZ are functions of the type of aircraft, which regularly operate at the airport, in conjunction with the specified visibility minimums of the approach (if applicable).

In consideration of the existing instrument approach minimums and the type of aircraft each runway is designed to accommodate, the following table, entitled *RUNWAY PROTECTION ZONE DIMENSIONS*, lists existing RPZ dimensional requirements, along with the requirements for improved approach capabilities.

The airport currently owns the land areas associated with the RPZs for Runway 16L/34R and Runway 11/29, except for a small area on the southern end of the RPZ associated with Runway 34R and a portion of the 16L RPZ over county owned Airport Road, on which the airport owns avigation easements.

Table C10
RUNWAY PROTECTION ZONE DIMENSIONS
Paine Field Master Plan Update

Item	Width at Runway End (feet)	Width at Outer End (feet)	Length (feet)
Existing RPZ Dimensions:			
Runway 16R	1,000	1,750	2,500
Runway 34L	1,000	1,510	1,700
Runway 16L	250	450	1,000
Runway 34R	250	450	1,000
Runway 11	250	450	1,000
Runway 29	250	450	1,000
Required RPZ Dimensions for Various Visibility Minimums:			
Not lower than 1-Mile,			
Small Aircraft Only	250	450	1,000
Approach Categories A & B	500	700	1,000
Not lower than 1-Mile,			
Approach Categories C & D	500	1,010	1,700
Not lower than 3/4-Mile, All Aircraft	1,000	1,510	1,700
Lower than 3/4-Mile, All Aircraft	1,000	1,750	2,500

Source: FAA Advisory Circular 150/5300-13, "Airport Design."

Please refer to the Appendix for policies and purpose for Runway Protection Zones gleaned from the *1997 Land Policy 97-02,* published by the FAA Seattle Airports District Office (ADO).

Future Lighting. Based on existing and future approach visibility minimums, it is recommended that the Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) on Runway 16R and the Medium Intensity Approach Lighting System with Sequenced Flashers (MALSF) on Runway 34L remain.

Glide path indicator lights are a system of lights that provide visual vertical approach slope guidance to aircraft during an approach to the runway. Precision approach path indicators (PAPIs) or Visual Approach Slope Indicators (VASIs) are designed for daytime and nighttime use during VFR (i.e., good weather) conditions. The PAPIs on Runways 16R/34L and 16L/34R are recommended to remain, while the VASIs associated with Runway 11/29 should be programmed to be supplanted with PAPIs.

Runway End Identifier Lights (REILs) are a system of lights that provide an approaching aircraft a rapid and positive identification of the approach end of the runway. At present, Runway 16L/34R is equipped with REILs. It is recommended that these be maintained. In the future, Runway 11/29 should be equipped with REILS.

In conjunction with its precision approach capabilities, the HIRL on Runway 16R/34L should be maintained, while the existing MIRL should remain for Runways 16L/34R and 11/29. In addition, Medium Intensity Taxiway Lighting (MITL) is presently in place on all taxiways at the airport except Taxilane E, Taxiway K-5, Taxiway K-6, and Taxilane H. MITL should be placed on all existing and new taxiways in the future.

Landside Requirements

Landside facilities are those facilities, which support the airside facilities, but are not actually a part of the aircraft operating surfaces. These consist of such facilities as terminal buildings, hangars, aprons, access roads, and support facilities. Following a detailed analysis of these facilities, current deficiencies can be noted in terms of accommodating both existing and future aviation needs at the airport.

Terminal Area Requirements

Components of the terminal area complex include the terminal building, gate/parking positions, apron area, vehicular access and auto parking. The following paragraphs identify the facilities required to meet the airport's needs through the planning period. Where noted, facility requirements have been utilized using the guidance of FAA Advisory Circular 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities,* January, 1994 and *Measuring Airport Landside Capacity*, Transportation Research Board, 1987.

Passenger Terminal Building. Based on the previously presented forecast number of passenger enplanements, and using estimates of peak hour demand derived from those passenger enplanement forecasts, planning rules-of-thumb can be used to establish an ultimate square footage estimate for a passenger terminal building in consideration of predicted demand. These rules-of-thumb state that .08 to .12 square feet of space per annual enplanement is the average space requirement needed to sufficiently accommodate passengers. However, experience at small/non-hub airports indicates that this number could be as high as .21 square feet per annual enplanement. Using .08 as the basis for a calculation, a terminal area of 12,212 square feet is projected by the end of the planning period and using .21, a terminal area of 32,054 square feet is projected by the end of the planning period. The incremental ranges of square footage for the terminal building can be seen in the following table, *PASSENGER TERMINAL BUILDING SQUARE FOOTAGE REQUIREMENTS.*

Table C11
PASSENGER TERMINAL BUILDING SQUARE FOOTAGE REQUIREMENTS
Paine Field Master Plan Update

Year	Forecast Passenger Enplanements	.08 Square Feet Per Annual Enplanement	.21 Square Feet Per Annual Enplanement
2006	126,425	10,114	26,549
2011	136,621	10,929	28,690
2016	144,630	11,570	30,372
2021	152,640	12,212	32,054

Source: Barnard Dunkelberg & Co.
AC 150/5360-13: Planning and Design Guidelines for Airport Terminal Facilities.

*Gate/Parking Positions***.** The airport does not currently maintain a passenger terminal facility. According to guidelines from FAA Advisory Circular 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities,* January 1994, estimates for the required number of aircraft parking positions were tabulated in consideration of the "Annual Utilization" method. It was projected that a total of three aircraft parking positions would be required at the airport by the end of the planning period, based on the previously presented enplanements and commercial service operational forecasts.

Terminal Area Vehicle Parking. There are three types of automobile parking typically located in the terminal area of the airport. These include public (passenger), rental car,

and employee parking. Because of the absence of passenger activity at the airport, the demand for terminal parking facilities has been minimized. For long-range planning purposes, the provision of an appropriate area for passenger terminal parking is an important consideration.

FAA planning guidelines indicate that, at non-hub airports, one parking space should be provided for each 500 to 700 annual enplaned passengers. This guideline would indicate that parking for as many as 305 vehicles could be required by year 2021. Over half of the existing 450 parking spaces in the terminal area are required to accommodate existing tenants. The remainder available will need to be supplemented by converting the NE end of the Inner Terminal Ramp to auto parking as passenger parking demand grows.

Automobile access to the passenger terminal facilities is also an important consideration. The airport is the front door to the community for air travelers. Peak hour passenger demand is forecast to increase to 136 peak hour passengers by the end of the 20-year planning period. With this increase in the volume of passengers, it is likely there will be a significant impact related to the need to increase the efficiency and capacity of the existing roadway system serving the terminal area. Therefore, it will be important to take into consideration the configuration of the passenger terminal area and the access roadway. The terminal should be aesthetically pleasing, portraying a sense of arrival, while the access roadway system should be efficient, non-confusing, and have an ease of use for egress/ingress routing.

Table C12
PASSENGER TERMINAL FACILITY REQUIREMENTS, 2000-2021
Paine Field Master Plan Update

	2000[1]	2006	2011	2016	2021
Forecast Peak Hour Passengers	N/A	77	88	98	136
Gross Terminal Square Feet	1,600[2]	26,549	28,690	30,372	32,054
Gates/Aircraft Parking Positions	3	3	3	3	3
Automobile Parking Spaces[3]	450[4]	252	273	290	305
Peak Hour Passenger Automobiles In Peak Direction	N/A	64	73	82	114

Source: Barnard Dunkelberg & Co.
AC 150/5360-13: Planning and Design Guidelines for Airport Terminal Facilities.
[1] Actual.
[2] That Portion of Existing Terminal Building Which Could Easily Accommodate Passenger Facilities (Managers Office and Flightline Services)
[3] Required for passengers.
[4] North Lot, Main Lot, and South Lot In Terminal Area currently used by multiple tenants.
N/A Not Applicable Under Existing Conditions

Air Cargo Requirements

Historically, airmail and airfreight activity has occurred at Paine Field to a limited degree. These air cargo operations have been conducted at the airport with small air taxi type aircraft (prop aircraft with the capability of seating less than sixty passengers). This includes a scheduled mail route (by Methow Airlines), which transports mail from the regional postal facility in Everett to the San Juan Islands and a number of aircraft hauling checks (AMERIFLIGHT). Additionally, UPS did move its entire Seattle operation to Paine Field's South Ramp in early 2001 for several weeks when Boeing Field was closed for repair of damage sustained by an earthquake. As previously stated, the County's adoption of the 1978/79 Mediated Role Determination has discouraged air cargo operations from occurring at the airport. However, it is assumed that, if there is a demand for cargo operations at Paine Field, it is likely to be only temporary, and would be accommodated on the South Ramp until the cargo use area at SEA-TAC is re-established when (and if) the Port of Seattle moves forward with construction of the South Aviation Support Area (SASA) at SEA-TAC.

General Aviation Requirements

The number and type of projected general aviation operations and based aircraft can be converted into generalized projections of landside facility needs. The accompanying table illustrates the type of facilities and the number of units or acres needed for that facility to accommodate the potential demand for each development phase. As can be seen, the itinerant general aviation aircraft apron requirements are projected to increase from 657,693 ft.^{2} (73,077 yds.^{2}) in the year 2006 to approximately 688,473 ft.^{2} (76,497 yds.^{2}) by the year 2021, while based aircraft apron requirements are projected to increase from approximately 171,720 ft^2 (19,080 yds.^{2}) to 187,920 ft^2 (20,880 yds.^{2}) for the same period. Based on existing and projected aircraft storage practices, it is likely that the majority of future based aircraft will require some type of indoor storage facility. It is projected that the future demand for aircraft storage at the airport will likely consist of both individual executive/corporate hangars and T-hangar facilities.

The following table, entitled *GENERAL AVIATION FACILITY REQUIREMENTS, 2000-2021*, depicts the acreage required for general aviation landside facilities during all stages of development. As can be noted, the actual types of indoor storage facilities needed to accommodate future based aircraft have been identified as T-hangars and executive/corporate hangars. It is also apparent that the acreage demands for future aviation facilities cannot be accommodated in the existing location for the 20-year planning period. The current airport layout plan proposes the relocation of the existing general aviation development area to both accommodate the expanded development requirements and improve security at the commercial service ramp. Alternative general aviation development areas will be investigated in the following chapter of this document. Because the actual number, size and location of future large FBO/maintenance hangars will depend on user needs and financial feasibility, the quantity of these facilities has not been projected.

Table C13
GENERAL AVIATION FACILITY REQUIREMENTS, 2000-2021
Paine Field Master Plan Update

	Total Number Required (In yd^2)				
Facility	**2000**	**2006**	**2011**	**2016**	**2021**
Itinerant/GA Apron	39,555	73,077	74,428	75,581	76,497
Based A/C GA Apron	208,500	19,080	19,800	20,880	20,880
Hangar Space					
T-hangars	283	431	449	464	465
Exec/Corp.	92	81	93	108	123

Source: BD & Co. Projections based on FAA AC 150/5300-13

Support Facilities Requirements

In addition to the aviation and airport access facilities described above, there are several airport support facilities that have quantifiable requirements and that are vital to the efficient and safe operation of the airport. The support facilities at Paine Field that require further evaluation include the aircraft rescue and firefighting facility, the fuel storage facility and the air traffic control tower.

Aircraft Rescue and Firefighting Facility (ARFF). FAA requirements for ARFF equipment and staff are based upon the length of the largest passenger air carrier aircraft that serves the airport with an average of five or more daily departures. At the present time, Paine Field is classified as an Index A airport, and satisfies the associated criteria and requirements with its ARFF equipment and staff. If the size of the scheduled passenger aircraft that operate at Paine Field exceeds the Index A criteria, there will be additional requirements for ARFF equipment, manpower, and facilities. The airport maintains a fire department with equipment and staff in excess of Index "A" requirements due to the large size of non-passenger carrying aircraft operations conducted by Boeing and Goodrich Inc. customers.

Fuel Storage Facility. Over the past five years, there has been an average of 3.28 million gallons of fuel sold per year at Paine Field. Based upon 2000 total operation counts, this equates to approximately 15.4 gallons per operation. As operations increase, fuel storage requirements can be expected to increase proportionately. By increasing the ratio of gallons sold per operation to adjust for the increased size of aircraft forecast to operate and be based at the airport, an estimate of future fuel storage needs can be calculated as a two-week supply during the peak month of operations. Further analysis to allocate space for accommodating additional storage for future needs of capacity will be conducted throughout the master planning process of this document.

Summary

The need for facilities, which have been identified in this chapter, can now be utilized to formulate the overall future Development Plan of the airport. The formulation of this plan will begin by establishing goals for future airport development and an analysis of development alternatives whereby demand for future airport facilities can be accommodated. These alternatives will be presented in the following chapter entitled, *CONCEPTS, ALTERNATIVES AND DEVELOPMENT PLAN.*

Concepts, Alternatives and Development Plan

Introduction

The purpose of this chapter is to present the Development Plan for Paine Field, in terms of both its concept and reasoning. This chapter provides a description of the various factors and influences, which will form the basis for the ultimate plan and program.

In concert with the status of the airport, some basic assumptions have been established which are intended to direct the development of the airport in the future. These assumptions are supported by the aviation activity forecasts and the various considerations on which the forecasts have been based. The assumptions also focus on continued airport development that centers upon facility enhancement, supports community needs, and generates economic growth.

Assumption One. The airport will be developed and operated in a manner that is consistent with the Snohomish County Code, federal and state statutes, federal grant assurances, and Federal Aviation Administration regulations.

Assumption Two. This assumption recognizes that this Master Plan Update for the airport is only the most recent effort in an on-going, long-term planning effort for Paine Field. In particular, the provisions and recommendations made in the 1978/79 Mediated Role Determination shall be considered in the formulation of development recommendations.

Assumption Three. This assumption relates to the size and type of aircraft that will utilize Paine Field and the resulting setback and safety criteria used as the basis for the layout of airport facilities. Because various areas on the airport are intended for use by aircraft with widely varying physical and operational characteristics, they can be designed with different criteria. For Runway 16R/34L and its supporting taxiway/ramp system, the design aircraft is the B-747-400. These portions of the airport should be designed using Airport Reference Code (ARC) D-V criteria. For Runway 16L/34R and Runway

11/29, which primarily accommodate general aviation aircraft under 12,500 pounds, design criteria as provided in ARC B-I (small aircraft only) are appropriate.

Assumption Four. Because of the importance of the general aviation and industrial aviation activity at the airport, the fourth assumption relates to the need for the airport to accommodate aircraft operations with great reliability. This indicates that the airport's runway system should be developed with adequate runway lengths and approach guidance facilities to accommodate the forecast operations under almost all weather conditions. In addition, the airport's runway and taxiway system should be designed to maximize operational flexibility and facilitate large aircraft industrial operations.

Assumption Five. Because landside development area at the airport is at a premium, the fifth assumption is that the plan for future airport development should strive to maximize the area available for aviation related activities. Aviation and non-aviation areas should be developed to be compatible with surrounding areas, as well as provide the maximum amount of revenues to help support airport operating and maintenance expenses.

Assumption Six. The sixth assumption focuses on the relationship of the airport to off-airport land uses and the compatible and complimentary development of each. This is inherent in the design considerations and placement of facilities so as to complement, to the maximum extent possible, off-airport development, and to enhance the compatibility of the airport environs with the operation of the airport.

Assumption Seven. This assumption states that, in consideration of the congested airspace surrounding Paine Field and in the Seattle Metropolitan Area, recreational activities such as parachuting, ballooning, and ultra-light activity will be discouraged from occurring near the airport.

Goals for Development

Accompanying these assumptions are several goals that have been established for purposes of directing the plan and establishing continuity in the future for airport development. These goals take into account several categorical considerations relating to the needs of the airport both in the short-term and the long-term, including safety, noise, capital improvements, land use compatibility, financial and economic conditions, public interest and investment, and community recognition and awareness. While most are project oriented, some obviously represent more tangible activities than others; however, all are deemed important and appropriate to the future of the airport.

It should be noted that *A Strategic Vision for Economic Strength* plan was completed in September 1993 and developed for Snohomish County. This economic and investment plan recognizes the need for Snohomish County to, "stabilize and expand its manufacturing base, educate the citizens, provide for safe neighborhoods, and build the infrastructure that allows the community to become a more diverse place with all the amenities needed and desired." The Snohomish County General Policy Plan, as updated in 1999, sets an objective to "maximize the growth potential of local Port and Airport resources through continued commitment of public financial resources, improved transportation access to the physical sites, and aggressive marketing".

As reflected in the following goals, which are intended to guide the preparation of this Master Plan Update and future development at Paine Field, the airport plays a vital role in this strategic vision both as a transportation facility and an industrial/commercial economic center.

Master planning and airport development goals:

- Provide effective direction for the future development of Paine Field through the preparation of a rational plan, followed by periodic updates and adherence to the adopted development program.

- As stated in the 1978/79 Mediated Role Determination adopted by the County as a policy statement, the airport has a "General Aviation" role. Activities that would be encouraged to continue and expand include: general aviation, aircraft related industries, business and corporate aviation, public service aviation, and air taxi/ commuter service.

- Mitigate negative airport impacts on surrounding residential development.

- Because of the operational requirements of the existing and projected aircraft fleet, the existing runway lengths at Paine Field should be retained.

- The instrument approach capabilities of Runway 16R/34L should be maximized.

- Maximize the aviation development area at Paine Field. This includes planning for the best use of the airport's undeveloped areas, planning for the redevelopment of several areas on the airport, and utilizing building designs that make efficient use of the limited amount of aviation-use land available (e.g., connected hangars vs. individual hangars).

- Enhance the self-sustaining capability of the airport by ensuring the highest and best use of airport land that maximizes revenue to offset the airport's operation and maintenance expenses.

- Plan and develop the airport to be environmentally compatible with the community and minimize environmental impacts on both airport property and property adjacent to the airport. Specifically, this has included development of high quality wetland compensation banks, storm water detention areas, and noise berms/walls. In addition, adverse noise intrusion should be minimized through aircraft operations planning and land use compatibility planning.

- Encourage the protection of the significant County and Federal investment in the airport's land and facilities, by striving to minimize existing and potential land use conflicts.

- Plan and develop the airport to be capable of accommodating the future needs and requirements of the county and surrounding communities, thus continuing to serve as a regional general aviation/industrial aviation facility.

- Continue to minimize and mitigate activities and development at the airport that might encourage aviation wildlife hazards.

Airside Development Concepts and Alternatives

Introduction

To best accommodate the projected operational demand at Paine Field through the year 2021, it is important to first analyze any alternatives related to future runway and/or instrument approach development. As defined in FAA planning terminology, airside facilities are those that are used during the active movement of aircraft; i.e., instrument approach facilities/equipment, runways, and taxiways.

In the formulation of alternatives, the forecast operations and goals of Snohomish County relative to aviation development and economic enhancement were considered. These generalized alternatives are discussed in the following narrative. Following a review of these airside development alternatives, the purpose of which is to fulfill *major* facility requirements (basic runway configuration), recommendations for landside development are presented. For purposes of this Master Plan Update, landside facilities consist of aircraft parking aprons, hangar development areas, terminal area development, industrial aviation development areas, associated use areas, and airport access. The conclusion of this chapter will be the presentation of a generalized conceptual airport

development plan that will include recommendations for runway and taxiway improvements along with an on-airport land use plan. Details related to the exact alignment and configuration of the runway/taxiway system and the layout of landside development areas will be presented in a following chapter, entitled *AIRPORT PLANS*.

Because all other airport functions relate to and revolve around the basic runway/ taxiway layout, airside development alternatives must first be carefully examined and evaluated. Specific considerations include taxiway layout, runway length, as well as runway orientation and instrument approach capabilities needed to support forecast use through the planning period. The main objective of the alternatives analysis presented herein is to analyze those alternatives that will result in a runway/instrument approach system capable of accommodating the forecast aircraft operations.

Alternatives

As stated previously, the basic runway system existing at the airport will remain in place for the foreseeable future. The need for additional runways or any major modification (extensions, approach threshold relocation, etc.) to the runway system has not been identified in this Master Plan Update.

There is, however, the need to examine the feasibility of implementing improved instrument approach capabilities at the airport. The north end of the main runway (Runway 16R) currently has precision instrument approach capabilities, while the south end of the main runway (Runway 34L) has a non-precision instrument approach. The secondary parallel runway (Runway 16L/34R), and the crosswind runway (Runway 11/29) are currently visual approach runways.

The single precision approach at Paine Field [Category I Instrument Landing System (ILS) approach from the north to Runway 16R] has some limitations with regard to full compliance with the airport's published Noise Abatement Program (NAP). To minimize low level flight over populated areas, the NAP for jet, turboprop, and large propeller aircraft discourages circling approaches, and requests pilots avoid turns before reaching the shoreline when departing on Runway 34L. When winds require landing from the south (Runway 34L), the single precision approach from the north makes a circling approach a necessity in instrument weather conditions. When winds require departures on Runway 34L, departing aircraft are often placed in a "head to head" conflict with aircraft on the Runway 16R instrument approach. Under these conditions, air traffic controllers require the departing aircraft to turn as soon as possible after departure to maintain a safe separation between the converging aircraft. The amount of instrument approach training activity at Paine Field is significant and is projected to increase in the future; thus, the frequency of the operational conditions described above is likely to increase in the future.

The options for improving this situation have been reviewed, including the potential for a second precision instrument approach to one of the other runway ends. The 1995 Paine Field Master Plan indicated that Runway 34L will have precision instrument approach capabilities with visibility minimums less than ¾ mile in the future. Appropriately, this provision was made in the 1995 Master Plan simply to protect the ability to implement a Runway 34L precision approach if feasible at some point in the future.

As described previously in the *CAPACITY AND FACILITY REQUIREMENTS* chapter, providing the best instrument approach capabilities that are feasible at Paine Field are very important from an airport utilization and safety standpoint. The better the instrument approach capabilities, the less time the airport might be non-operational due to poor weather conditions. The airport experiences weather conditions with cloud ceilings and/or visibility conditions less than VFR minimums, but greater than the precision approach weather minimums (200-foot cloud ceiling and/or visibility of ½ mile) approximately 8.9% of the time annually. Weather conditions with cloud ceilings and/or visibility conditions less than VFR minimums, but greater than the non-precision approach weather minimums associated with Runway 34L (421-foot cloud ceiling and/or visibility of ¾-mile) occur approximately 7.7% of the time annually.

With regard to the previously stated goals, alternative examination is intended to maximize the instrument approach capabilities at the airport. The airspace around Paine Field and in the Seattle Metropolitan area is complex with many interrelated issues. In addition, facility and technological improvements (e.g., radar and GPS) are in the process of being implemented, which will change how air traffic and approach procedures are controlled in the vicinity of Paine Field.

There are two sets of characteristics that are analyzed in considering the implementation of improved instrument approach capabilities. The first is physical; i.e., on-site facilities, lighting, and property ownership. The second is land use within the Runway Protection Zone (RPZ). The RPZ's function is to enhance the protection of people and property on the ground. FAA policy standards indicate that certain land uses are to be prohibited within an RPZ; e.g., fuel storage facilities, residences, and places of public assembly. The FAA strongly recommends that an airport owner have control of the entire RPZ area through acquisition of sufficient property interest to control the height of objects and land use. If the airport has ownership control of the RPZ area, the land use policy standards with regard to prohibited activities are enforced as requirements. Where it is impracticable for the airport sponsor to acquire full control of the RPZ area, the RPZ land use standards have recommendation status for the portion of the RPZ not controlled by the airport owner.

Recommendation. Following additional discussion with several FAA divisions, it is recommended that the airport should continue to protect for a lower-than ¾ mile visibility minimum precision approach to Runway 34L. A detail of the physical layout of existing and future RPZs, approach lighting systems, and instrument approach facilities is provided in the following illustrations. The first illustration is entitled *RUNWAY 34L INSTRUMENT APPROACH DETAIL NOT LOWER THAN ¾-MILE VISIBILTIY MINIMUM*. The second illustration is entitled *RUNWAY 34L INSTRUMENT APPROACH DETAIL LOWER THAN ¾-MILE VISIBILITY MINIMUM*. As can be noted, the existing approach visibility minimum can be accomplished with a relatively simple Medium Intensity Approach Light System with Sequenced Flashing Light (MALSF). To support a lower than ¾-mile visibility minimum approach, a more sophisticated Medium Intensity Approach Light System with Runway Alignment Indicator Lights (MALSR) is needed.

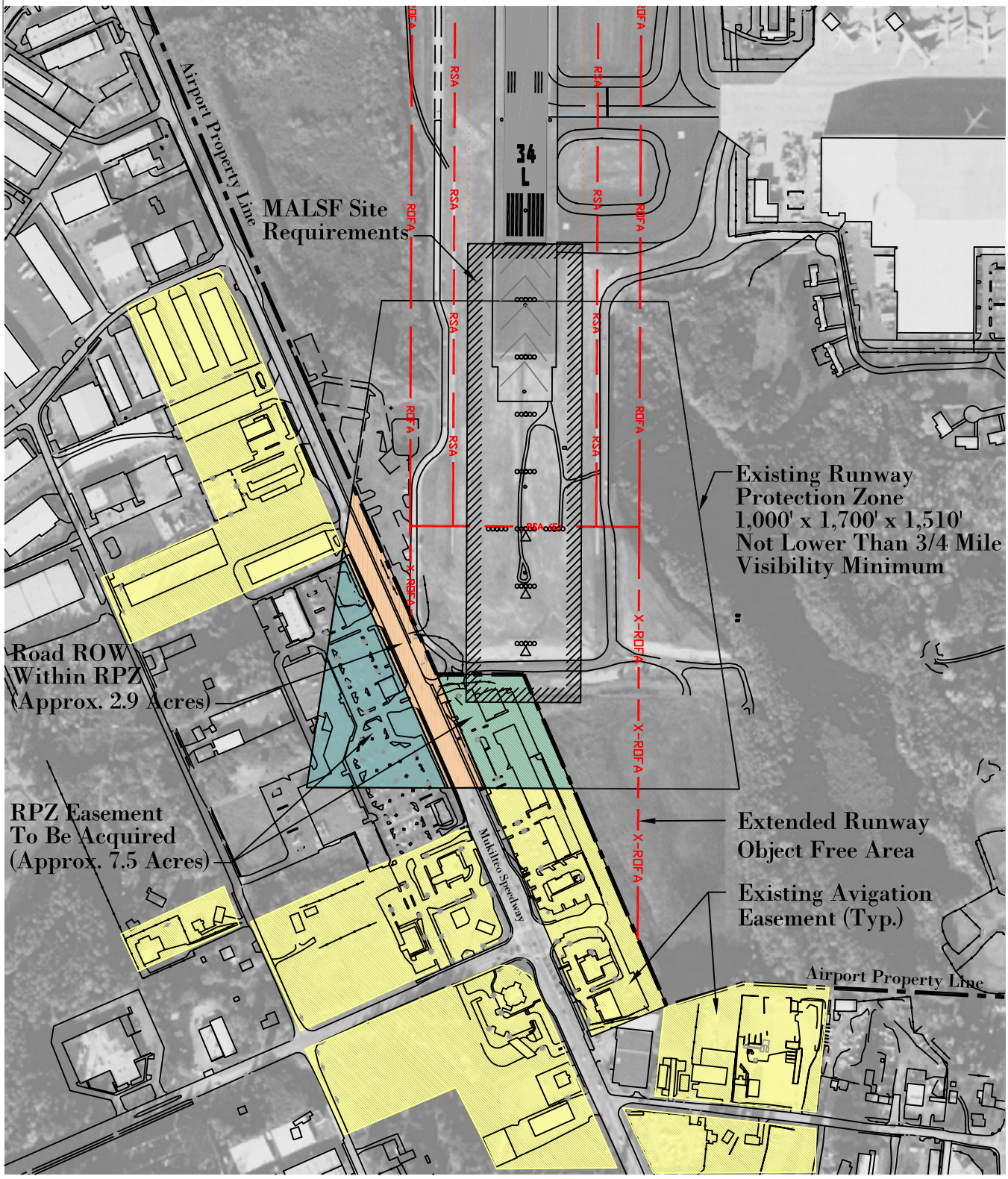
This is a long-term recommendation. The demand for a low minimum precision instrument approach to Runway 34L is presently not sufficient to justify its implementation; however, at some point in the future this improvement may become more important. Even if a lower minimum approach is programmed in the future, it remains a priority that a straight-in VOR approach (and/or a better more usable non-precision GPS approach) be established to serve Runway 34L.

Taxiway Improvements

The existing taxiway system at the airport is arranged to be an efficient and safe system to facilitate the movement of aircraft to and from the runway system. As additional aviation facilities are developed, (e.g., on the west side of the airport), new access taxiways will be constructed as needed.

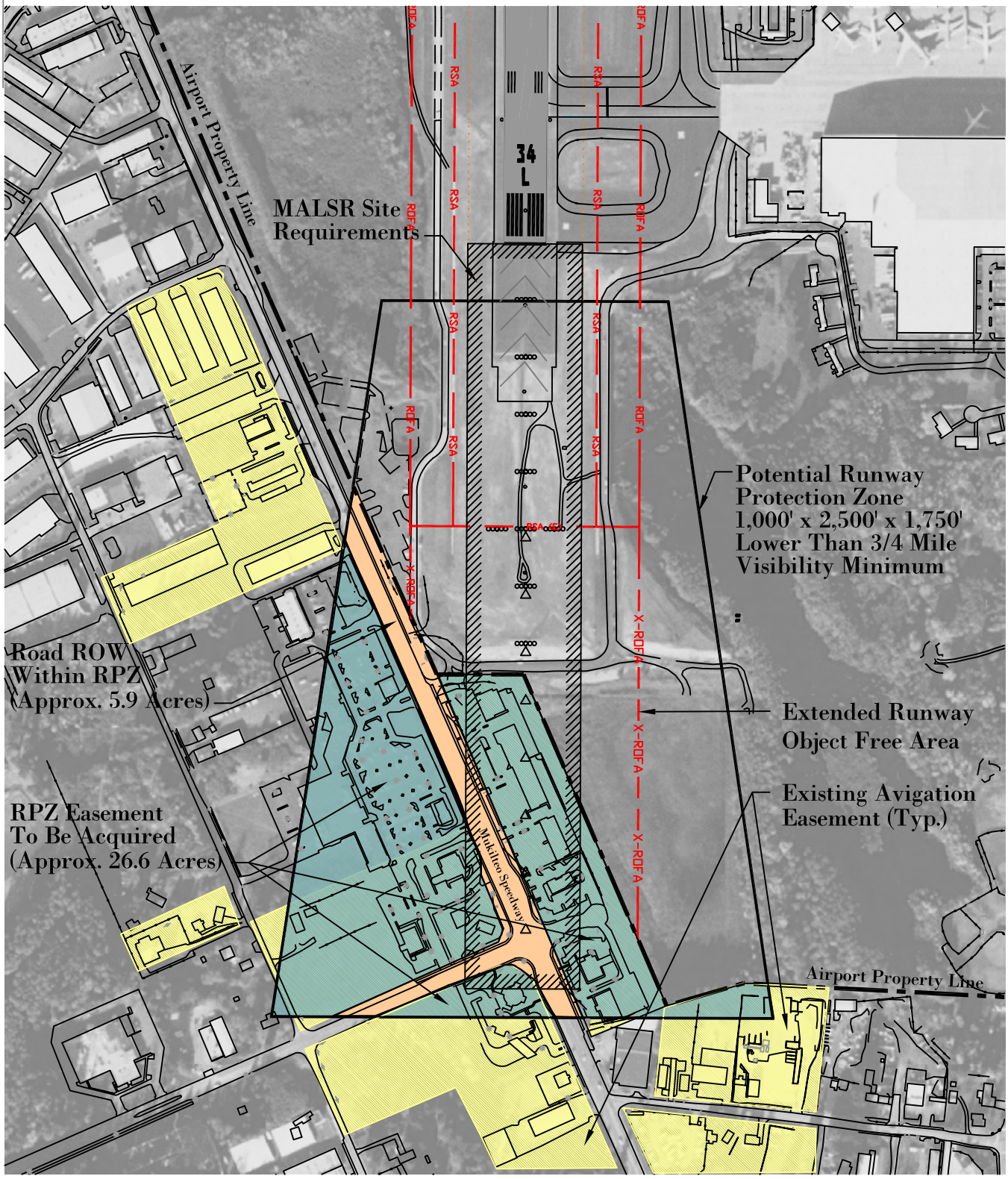
Recommendation. From a general airport-use standpoint, several taxiway improvements have been identified. First, a 90° exit taxiway from the main runway to Taxiway A between existing Taxiways A-2 and A-3 would be well utilized by many large (e.g., Boeing 767/777) aircraft landing on Runway 34L. The second is to ensure that proper object setback standards are met to allow large aircraft (B-747-400) unimpeded use of the south end of Taxiway A. This will require limiting access to the west side of an older hangar structure (#221), along with the ARFF/maintenance building, and some relocation of fencing.

To support the substantial concentration of small aircraft storage hangars on the west ramp, a new taxiway connecting Taxilane E and Taxilane H should be constructed west of and parallel to Runway 11/29. Also, a run-up area should be constructed adjacent to Taxiway A-4. In addition to maintaining Taxiways K-5 and K-6, the west side of the main runway should be provided with new access taxiways opposite A-1 and opposite the above mentioned new 90°exit between Taxiways A-2 and A-3.



1" = 500'

Figure D1 Runway 34L
Instrument Approach Detail
Not Lower Than 3/4-mile Visibility Minimum



1" = 500'

Figure D2 Runway 34L
Instrument Approach Detail
Lower Than 3/4-mile Visibility Minimum

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Recommended Airside Development Plan

The airside development discussion provided above is intended to present Snohomish County with potential options to facilitate the formulation of an ultimate layout of facilities at the airport. Because no major changes in the runway/taxiway system at the airport are envisioned, the alternative considerations are limited. The development options were discussed with the Study Advisory Committee, Airport Staff, and the FAA before a decision was made on the preferred long-term layout of future airside facilities. The following illustration, entitled *AIRSIDE DEVELOPMENT PLAN*, provides a graphic illustration of existing and proposed airside facilities, along with the areas encompassed by runway safety areas, runway object free areas, critical taxiway object free areas, building restriction lines, and runway protection zones. It also indicates those areas on airport property that are outside of all the runway safety and object clearing zones, and are available for future development of landside facilities.

Landside Development Concepts

Introduction

With the framework of the airport's ultimate airside development identified, alternatives involving the placement of needed landside facilities can now be analyzed. The overall objective of the landside development at the airport is the provision of facilities that are conveniently located and accessible to the community, which accommodate the specific requirements of airport users. For purposes of this Master Plan Update, landside facilities consist of aircraft parking aprons, hangar development areas, terminal area development, industrial aviation development areas, associated use areas, and airport access.

Definitions

Several terms are used in the following paragraphs to identify development areas that require definitions:

Runway, Taxiway, and Approach System. These areas are reserved for aircraft movement and approach protection. They include all areas that are contained in FAA defined Runway Safety Areas, Object Free Areas, and all the area inside the established Building Restriction Line. The distance that a building restriction line is located away from a runway varies, depending on the largest aircraft designated to use a particular runway, the instrument approach capabilities provided to the runway, and the height of buildings (above the runway surface) expected in a certain area.

Barnard Dunkelberg & Company
1616 East 15th Street
Tulsa, Oklahoma 74120
918.585.8844 staff@bd-c.com

Figure D3
Airside Development Plan

Runway, Taxiway & Approach System
Runway Protection Zones
Existing Building Restriction Line
Existing Runway Safety Area
Existing Runway Object Free Area
Airport Property Available for Development
Future Airport Property Acquisitions

BOEING COMPANY 747/767/777 ASSEMBLY BUILDING
BOEING COMPANY 747/767/777 AIRCRAFT PARKING RAMP
BOMARC INDUSTRIAL/OFFICE DEVELOPMENT
FUTURE PROPERTY ACQUISITION
EVERETT CITY LIMITS
MUKILTEO CITY LIMITS
S.R. 526
AIRPORT ROAD
EVERETT SKILL CENTER
EAST RAMP
NORTH RAMP
CENTRAL RAMP
INNER (TERMINAL) RAMP
BACK TERMINAL RAMP
SOUTH RAMP
WEST RAMP
GOODRICH RAMP
FUTURE ATCT
TAXILANE H
TAXIWAY A
TAXIWAY B
TAXIWAY K-5
RUNWAY 16R/34L 150' X 9010'
RUNWAY 16L/34R 75' X 8500'
RUNWAY PROTECTION ZONE
RUNWAY OBJECT FREE AREA
RUNWAY SAFETY AREA
EXISTING VISUAL APPROACH RPZ 250' X 450' X 1000'
EXISTING/FUTURE APPROACH RPZ 250' X 450' X 1000'
EXISTING/FUTURE DEPARTURE RPZ 250' X 450' X 1000'
POTENTIAL RUNWAY PROTECTION ZONE VISIBILITY MINIMUMS LESS THAN 3/4 MILE 1000' X 1750' X 2500'
EXISTING RUNWAY PROTECTION ZONE VISIBILITY MINIMUMS NOT LESS THAN 3/4 MILE 1000' X 1510' X 1200'
EXISTING/FUTURE RUNWAY PROTECTION ZONE VISIBILITY MINIMUMS LESS THAN 3/4 MILE 1000' X 1750' X 2500'
DEICE PAD
NOISE BERM
35' ABOVE R/W & STRUCTURE HEIGHT BUILDING RESTRICTION LINE (BRL)
15' BRL
BUILDING RESTRICTION LINE & PART 77 PRIMARY SURFACE
(Actual building locations will vary depending on ground elevations.
No penetration of Part 77 Transitional Surface to be allowed.)
PAINE FIELD BOULEVARD
FUTURE PROPERTY ACQUISITION
FAIRMONT ELEMENTARY SCHOOL
HOUSING AUTHORITY
REVELS ROAD
SNOHOMISH COUNTY PUBLIC WORKS
P.P.

GRAPHIC SCALE IN FEET
0 250' 500' 1000' 1500'

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Runway Protection Zones. These areas include all existing and future Runway Protection Zones (RPZs). As stated above, the RPZ's function is to enhance the protection of people and property on the ground. The FAA recommends that an airport owner have control of the entire RPZ area through acquisition of sufficient property interest to control the height of objects and land use; however, where it is impracticable for the airport sponsor to acquire full control of the RPZ area, the requirements for land use control are considered to be recommendations.

Aviation Use Development With Taxiway Access. These areas are outside of the Building Restriction Lines (BRL) associated with the runway system and possess physical characteristics indicating the potential for taxiway access at some point in the future. The ability to provide these areas with taxiway access indicates that they should be reserved for aviation use.

Airport Compatible Development Without Taxiway Access. All future development within the bounds of the airport will be compatible with the primary purpose and function of the airport and will bring in lease revenue to support the operation of the airport. Some areas of the airport are not likely to be provided with taxiway access and are not identified for aviation use (although they can be utilized for an aviation support activity that does not require runway/taxiway access). The revenue generation potential of these areas will vary based on local traffic and road access. The development proposal for each specific site must be customized in consideration of these locational characteristics. County code should be modified to allow hotel development that supports airport activity.

Specific proposals for non-aviation use will undergo additional review.

Future Airport Property Acquisition. Because of their strategic locations adjacent to existing airport property, three parcels of land in the southeast quadrant of the airport have been identified for potential acquisition. If acquired, these three parcels will remain in airport compatible, non-aviation use.

Using these definitions, the potential uses of airport property can be established using the overall guideline that all airport property, which can be reasonably provided with taxiway access, should be reserved for aviation use in the long-term. The land use concept for the airport is presented by geographic area in the following illustration, entitled *ON-AIRPORT LAND USE PLAN*. In addition to designation of land use, the size

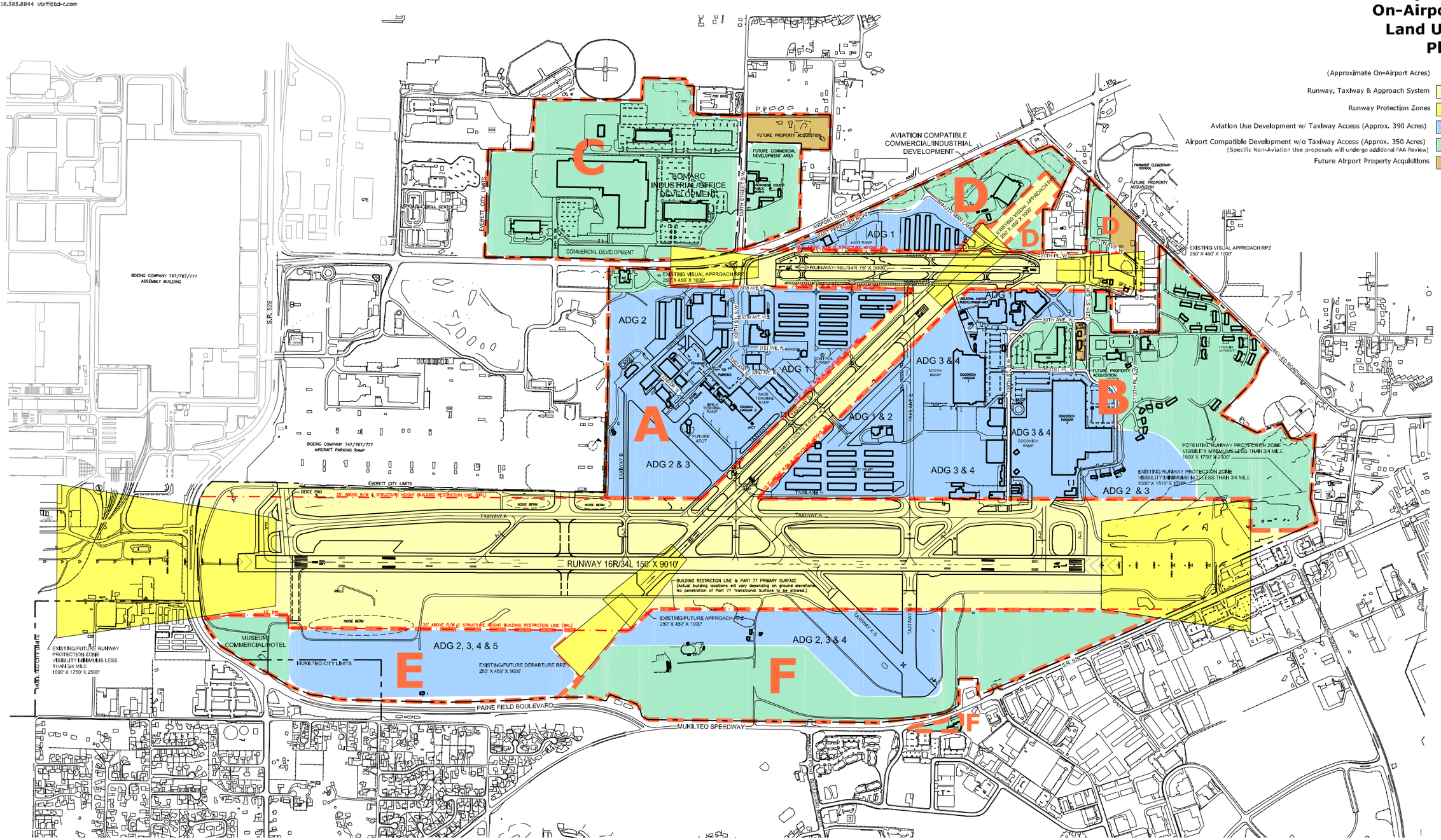
Barnard Dunkelberg & Company
1616 East 15th Street
Tulsa, Oklahoma 74120
918.585.8844 staff@bd-c.com

Figure D4

On-Airport Land Use Plan

(Approximate On-Airport Acres)

- Runway, Taxiway & Approach System
- Runway Protection Zones
- Aviation Use Development w/ Taxiway Access (Approx. 390 Acres)
- Airport Compatible Development w/o Taxiway Access (Approx. 350 Acres)
  (Specific Non-Aviation Use proposals will undergo additional FAA Review)
- Future Airport Property Acquisitions



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of aircraft [by Airplane Design Group (ADG)] likely to use each area has also been identified. The wingspans associated with the various ADGs, along with example aircraft types are listed below.

- ADG 1 – Wingspans up to 49 feet, including most of the small propeller driven general aviation aircraft.
- ADG 2 – Wingspans of 49 feet up to 79 feet. This group includes all of the larger general aviation aircraft and a majority of the business jets, with the exception of the new very large business jets. The turboprop and regional jet commercial passenger aircraft are also included in this category.
- ADG 3 – Wingspans of 79 feet up 118 feet. This group includes the new very large business jets (e.g., the Boeing Business Jet, the Gulfstream V, etc.) and most of the narrow body commercial passenger jet aircraft (i.e., the B-737, A-320, MD-80, etc.).
- ADG 4 - Wingspans of 118 feet up to 171 feet. This group includes the largest narrow body commercial passenger aircraft (the B-757, etc.) and the smaller wide body commercial passenger aircraft (the B-767, MD-11, etc.).
- ADG 5 – Wingspans of 171 feet up to 214 feet. The larger wide body commercial passenger aircraft (B-747, B-777, etc.) are included in this design group.
- ADG 6 –Wingspans of 214 feet up to 262 feet. This group includes very large cargo aircraft (i.e., the AN-124 and the Lockheed C-5B).

Conceptual Development Plan

Introduction

The next step in the establishment of a long-term development plan for Paine Field is to, where possible, detail the shape of development areas and/or formulate a conceptual building layout for the land use areas presented in previous illustrations. These more detailed conceptual building area plans and structure locations can only be provided for parcels where a relatively good idea of demand can be established.

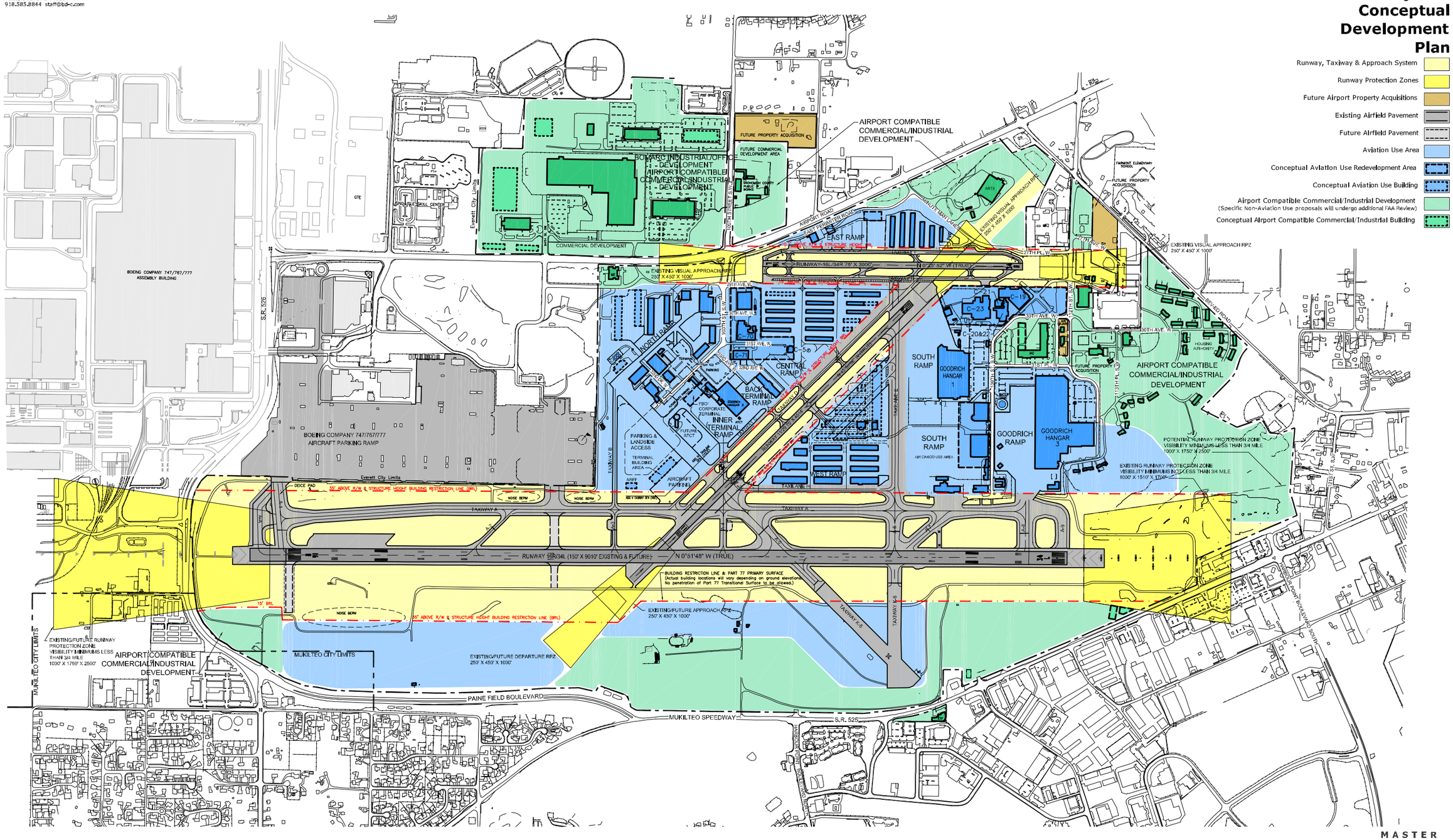
The focus of the Conceptual Development Plan proposal is on the various sites that are currently available for new development and those sites where redevelopment (removal of old facilities and replacement with new) is likely to occur. An illustration of the *CONCEPTUAL DEVELOPMENT PLAN* is provided on the following page.

Barnard Dunkelberg & Company
1616 East 15th Street
Tulsa, Oklahoma 74120
918.585.8844 staff@bd-c.com

Figure D5

Conceptual Development Plan

- Runway, Taxiway & Approach System
- Runway Protection Zones
- Future Airport Property Acquisitions
- Existing Airfield Pavement
- Future Airfield Pavement
- Aviation Use Area
- Conceptual Aviation Use Redevelopment Area
- Conceptual Aviation Use Building
- Airport Compatible Commercial/Industrial Development (Specific Non-Aviation Use proposals will undergo additional FAA Review)
- Conceptual Airport Compatible Commercial/Industrial Building



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Area A (Central, Terminal, and North Ramps)

This area is located between the parallel runways, north of Runway 11/29. Currently, it is one of the most intensely developed areas on the airport. The efficient use of the available development space in Area A is critical. It currently contains a variety of functions, such as airport administrative offices, general aviation terminal facilities, general aviation hangars, FBO facilities, corporate aviation facilities, and industrial aviation facilities, which front on the airport's Central, Terminal, and North Ramps.

Because the area has excellent airside and landside access, including an adequate aircraft parking ramp, it is programmed to continue to accommodate many of the airport's general aviation, industrial aviation, and administrative facilities, along with the airport's passenger terminal facility. It is expected that, in the long-term, the industrial aviation uses in Area A will be shifted to other areas on the airport.

Following the events of September 11, 2001, increased security requirements have restricted automobile parking in close proximity to a passenger terminal building (+/- 300 feet, depending on the structural design of the terminal building). It is expected that these increased security requirements will remain in place for the foreseeable future. Because of this, if commercial passenger service is initiated at Paine Field (even a limited regional service such as Horizon Airlines' recent proposal for a Paine Field to Portland route), it will be extremely unlikely that the passenger terminal function could be accommodated in an existing structure within Area A. Therefore, a new terminal building/administration building located in the infield area northeast of the intersection of Runway 16R/34L and Runway 11/29 is being proposed. Security requirements of the Federal Aviation Administration and the Transportation Safety Administration are evolving and the further refinement of the proposed terminal location recommendation may be required. A site for a new Aircraft Rescue and Fire Fighting facility has also been identified in the northwest corner of Area A.

In addition to the passenger terminal facility development area described above, Area A has two other undeveloped tracts that are identified for aviation use development. The first is located on the northeast end of the inner terminal ramp, east of the new Air Traffic Control Tower (ATCT). This area, along with the Passenger Terminal Development area will be designed to accommodate the largest business jets and the small to medium size commercial passenger service aircraft (i.e., Gulfstream V, B-737, etc. - ADG 3). This area is programmed for the development of FBO/General Aviation Terminal facilities. The second is located in the northeast corner of Area A (the north ramp area). This area will continue to be developed for hangar facilities to accommodate medium to large general aviation aircraft (up to ADG 2 aircraft).

In addition, the north side of the Central Ramp area will likely be redeveloped for aviation use. This area currently contains the airport's restaurant (Building C-57), along with Buildings C-5 and C-71. When redeveloped, this area will continue to support facilities for smaller general aviation aircraft (ADG 1).

Area B (West Ramp and South Ramp)

This area is located between the parallel runways south of Runway 11/29. Like Area A, Area B is also intensely developed. Existing facilities include the industrial aviation facilities (primarily related to Goodrich Inc.) and general aviation facilities.

It is important that potential development areas within Area B be well utilized. New general aviation hangars are programmed for the eastern portion of the west ramp. In addition, the eastern portion of Area B (adjacent to Runway 16L/34L - containing buildings C-19, C-20 C-21, C-22, and C-23) is programmed for aviation redevelopment, which will be focused on general aviation use.

The potential to accommodate new industrial aviation development is identified in the area to the southwest of Goodrich Hangar 3. Industrial aviation redevelopment is identified for the South Ramp area (Buildings 201 and 207). The south ramp has also been identified as the location on the airport that could accommodate a temporary use by large air cargo aircraft.

Because potential development areas on the airport, or directly adjacent to the airport, are at a premium and to ensure land use compatibility, the former Navy Housing tract in Area B was acquired in 1996. The majority of this tract (the southern portion of Area B) is identified for Airport Commercial/Industrial Development.

Area C (Bomarc)

This area is located east of Runway 16L/34R and northeast of Airport Road. In addition to continued use of the area for the Bomarc Business Park and its related functions, the area south of 100th St S.W. (currently containing Snohomish County Public Works Department facilities) should be utilized for airport compatible commercial/industrial development. In addition, the plan identifies a parcel of land to be acquired on the east side of the county maintenance area.

Area D (East Ramp)

Area D is located East of Runway 16L/34R and currently contains several general aviation hangars. The portion of the area adjacent to the parallel taxiway on the east side of Runway 16L/34R, which is undeveloped, is designated for aviation use and should be

utilized for additional general aviation facilities (ADG 1) . The tract in Area D, south of Minuteman Lane, is designated for airport compatible commercial/industrial development and currently contains the County's Solid Waste Transfer Station. In addition, there is a small tract in Area D located directly east of the Runway 34R RPZ, along with an adjacent tract that is recommended for acquisition. These tracts are programmed for Airport Compatible Commercial/Industrial facilities.

Area E (West Side-North)

This area is located west of Runway 16R/34L north of the RPZ associated with the approach to Runway 11. This area is currently undeveloped; however, it has excellent potential for taxiway access and has been designated to be used primarily for aviation facilities. This area can accommodate large corporate-type general aviation facilities or industrial aviation functions (e.g., expansion area for the Boeing Company, which has leasing right-of-first-refusal on this property). The layout of Area E facilities can be designed to accommodate large aircraft (up to ADG 5). The northern most portion of this area has been identified for commercial aviation/airport-related facilities including tour center, hotel, restaurant, and museum development.

Area F (West Side-South)

Area F is located west of Runway 16R/34L, south of the Runway 11 RPZ. The site immediately south of the Runway 11 RPZ contains several wetlands and has a significant amount of topographic relief; therefore, development for aviation use facilities will be limited to only that area in close proximity (within 950' of runway centerline) to the runway, where earth fill quantities will be minimized.

The portion of Area F that is adjacent to Taxiways K-5 and K-6 is programmed for aviation use. This site is likely to accommodate large corporate-type general aviation facilities. To minimize the amount of fill needed for the construction of hangars on the northern portion of Area F, it is anticipated that a partial parallel access taxiway will be constructed which slopes down from Taxiway K-5.

The area south of Taxiways K-5 and K-6, in Area F, is programmed for airport compatible development. Some of the area will remain open to accommodate existing wetlands. In the past, a park & ride facility has been proposed for the southern portion of this area.

Environmental Processing Requirements

A general explanation of the Federal [National Environmental Policy Act (NEPA)] and State [Washington State Environmental Policy Act (SEPA)] environmental documentation/clearance process is provided below.

Federal. In 1969, Congress passed the National Environmental Policy Act (NEPA) that required Federal agencies to consider the environmental impact of Federal actions. As a result of the NEPA, the FAA has developed detailed guidance documents titled FAA Order 1050.1D "Policies and Procedures for Considering Airport Environmental Impacts", and for airport development actions, FAA Order 5050.4A "Airport Environmental Handbook". In addition to describing the contents of environmental documents, these FAA orders describe the process by which Federal agencies are required to consider environmental issues as a part of their decision-making.

As is noted in FAA Order 5050.4A, not all development proposals require the preparation of environmental documents. This order specifically identifies the following categories for considering the environmental impact of Federal actions:

- **Categorical Exclusions** are projects excluded from the need to prepare environmental documents, as their impacts are presumed to not be significant;

- **Environmental Assessment (EA)** - if a project might result in environmental impacts, an EA is often prepared. If the action is found to result in a significant environmental impact that is not mitigated, an EIS is then prepared. If no significant unmitigated impacts are identified, the Federal agency then typically issues a Finding of No Significant Impact (FONSI).

- **Environmental Impact Statement (EIS)**: An EIS is a detailed assessment of the impacts of a proposed action and its alternatives.

The following table, entitled *ACTIONS UNDER NEPA REQUIRING VARIOUS TYPES OF ANALYSIS*, lists the actions that typically require one of the above types of actions.

Table D1
ACTIONS UNDER NEPA REQUIREING VARIOUS TYPES OF ANALYSIS
Paine Field Master Plan Update

Categorical Exclusions **	**Environmental Assessment /FONSI ****	**Environmental Impact Statement**
Runway, taxiway, apron, or loading ramp or repair work except where project will create adverse off-airport impacts	Airport location	First time Airport Layout Plan Approval for a Particular Airport
Installation or upgrading of airfield lighting systems	New runway (except as noted for an EIS)	A new runway capable of accommodating air carrier aircraft in a major metropolitan area
Installation of miscellaneous items including segmented circles, wind or landing direction indicators, fencing, etc.	Major runway extension	Actions for which an EA has shown the need to prepare an EIS
Construction or expansion of passenger handling facilities	Change in runway strength that could result in a significant noise increase to noise sensitive uses inside 65 DNL	
Construction, relocation or repair of entrance and service roadway	Construction or relocation of entrance or service road connections to public roads which adversely affect roadway capacity	
Grading or removal of obstructions on airport property and erosion control actions with no off-airport impacts	Land acquisition associated with the above	
Landscaping generally, and landscaping or construction of physical barriers to diminish impact of airport blast and noise	Establishment or relocation of instrument landing system or an approach lighting system	
Projects to carry out noise compatibility projects	Any action that triggers: ✓ Use of DOT 4(f) land (such as a park or historic site) ✓ Effect on a site on or eligible for listing on the National register of Historic Places ✓ Conversion of valuable farmland ✓ Impacts to wetlands, coastal zones, or floodplains ✓ Impacts to endangered species	
Land acquisition associated with any of the above	Conveyances of government land for airport purposes	
Federal release of airport land		
Removal of Displaced Thresholds		

** Extraordinary Circumstances- Issues such as impacts to DOT 4(f) lands, wetlands, coastal zones, endangered species, historic sites, protected farmland may require a higher level of environmental impact analysis. In addition, "an action that is likely to be highly controversial on environmental grounds" may represent extraordinary circumstances if opposed on environmental grounds by a Federal, State or local governmental agency or is opposed by a substantial number of persons affected by the action.

State. First adopted in 1971, the State Environmental Policy Act (SEPA) provided Washington State's basic environmental charter. Several years of committee work led to the 1974 legislative creation of the Council on Environmental Policy to write rules to interpret and implement SEPA. SEPA was modeled after the NEPA, and became effective in January 1976 (Washington Administrative Code 197-10). Within SEPA, the following types of environmental processing are required:

- **Environmental Checklist** – a formal screening analysis to identify if the impacts of the project are significant and require mitigation. If the impacts are determined to be non-significant, the responsible SEPA official can issue a notice or "Determination of Non-Significance" (DNS). If impacts are not significant after mitigation, the responsible SEPA official could also issue a "Mitigated Determination of Non-Significance" (MDNS).
- **Environmental Impact Statement** – if the impacts of the project are likely to be significant, the responsible SEPA official may require preparation of an EIS.

Environmental Considerations

Federal

In consultation with the Federal Aviation Administration, the critical environmental aspects for this Master Plan were identified as Aircraft Noise Exposure and Air Quality. From a federal perspective, no "project construction" environmental clearance is attributed to an Airport Master Plan. Therefore, no environmental impact documentation is required as an element of the preparation of an Airport Master Plan. It is also recognized that the implementation of the improvements specified in this Master Plan could have environmental consequences and that Snohomish County should be aware of environmental impact potentials for certain critical aspects. These aspects are discussed in more detail below.

Aircraft Generated Noise. Noise impacts are certainly significant ingredients in establishing a basis for valid land use planning practices within the full environs of the airport. In many cases, noise impacts encompass a greater area than those covered by other considerations; however, safety factors in the form of runway protection zones and approach surfaces [including height restrictions on manmade and natural objects to conform with FAR Part 77 – Objects Affecting Navigable Airspace (see *AIRPORT AIRSPACE DRAWING* in Airport Plans Chapter)] are additional ingredients on which to base land use decisions and implementation practices. These same land use planning practices and mechanisms are appropriate for both noise and safety concerns and should be employed in terms of establishing a proper and realistic set of land use recommendations for the airport environs.

Noise is generally defined as unwanted sound and, as such, the determination of acceptable levels is subjective. The day-night sound level (DNL) methodology is used to determine both the noise levels resulting from existing conditions and the potential noise levels that could be expected to occur at the end of the 20-year planning period. The basic unit in the computation of DNL is the Sound Exposure Level (SEL). An SEL is computed by adding the "A" weighted decibel level [dB(A)] for each second of a noise event above a certain threshold ("A" weighted refers to the sound scale pertaining to the human ear). For example, a noise monitor located in a quiet residential area [40 dB(A)] receives the sound impulses of an approaching aircraft and records the highest dB(A) reading for each second of the event as the aircraft approaches and departs the site. Each of these one-second readings is then added logarithmically to compute the SEL. The following table, entitled *COMPARATIVE NOISE LEVELS*, depicts the general dB(A) values of noise commonly experienced by people. This illustrates the relative impact of single event noise in "A" weighted level.

Table D2
COMPARATIVE NOISE LEVELS
Paine Field Master Plan Update

Activity	dB(A) Levels
Rustling Leaves	20
Room in Quiet Dwelling at Midnight	32
Soft Whisper at 5 Feet	34
Men's Clothing Department of Large Store	53
Window Air Conditioner	55
Conversational Speech	60
Household Department of Large Store	62
Busy Restaurant	65
Vacuum Cleaner in House (at 10 feet)	69
Ringing Alarm Clock (at 2 feet)	80
Loudly Reproduced Orchestral Music in Large Room	82
Printing Press Plant (medium size automatic)	86
Heavy City Traffic	92
Heavy Diesel-Propelled Vehicle (at 25 feet)	92
Air Grinder	95
Cut-off Saw	97
Home Lawn Mower	98
Turbine Condenser	98
150 Cubic Foot Air Conditioner	100
Banging of Steel Plate	104
Air Hammer	107

Note: Prolonged levels over 85 dB(A) represent beginning of hearing damage.
Adapted from Impact of Noise on People, Federal Aviation Administration.

The DNL index is a 24-hour, time-weighted energy average noise level based on the A-weighted decibel. It is a measure of the overall noise experienced during an entire day. Time-weighted refers to the fact that noise occurring during certain sensitive time periods is penalized. In the DNL scale, noise occurring between the hours of 10 p.m. to 7 a.m. is penalized by 10 dB. This penalty was selected to attempt to account for the higher sensitivity to noise in the nighttime and the expected further decrease in background noise levels that typically occur in the nighttime. DNL is specified by the FAA for airport noise assessment, and the Environmental Protection Agency (EPA) specifies DNL for community noise and airport noise assessment.

DNL levels are usually depicted as grid cells or noise contours. Grid cells are squares of land of a specific size that are entirely characterized by a noise level. Noise contours are interpolations of noise levels based on the center of a grid cell and drawn to connect all points of similar level. Noise contours appear similar to topographical contours and form concentric "footprints" about a noise source. These footprints of DNL noise contours drawn around an airport are used to predict community response to the noise from aircraft using that airport.

The main advantage of DNL is that it provides a common measure for a variety of differing noise environments. The same DNL level can describe both an area with very few high level noise events and an area with many low level events. DNL is thus constructed because it has been found that the total noise energy in an area best predicts community response. It must be remembered that the DNL noise contours do not delineate areas that are either free from excessive noise or areas that will be subjected to excessive noise. In other words, it cannot be expected that a person living on one side of a DNL noise contour will have a markedly different reaction than a person living nearby, but on the other side of the noise contour. What can be expected is that the general aggregate community response to noise within the 65 DNL noise contour, for example, will be less than the public response from the 70 DNL noise contour, and even less still than the response from within the 75 DNL noise contour.

In order to consider future noise impacts for the twenty-year Development Plan, as described in Master Plan Update, existing and future noise contour maps have been prepared, and are illustrated in the following figures, entitled *EXISTING (2000) NOISE CONTOURS & GENERALIZED EXISTING LAND USE* and *FUTURE (2021) NOISE CONTOURS & GENERALIZED EXISTING LAND USE*. The formulation of these noise contours takes into consideration existing and forecast operational assumptions, flight track utilization [FAA/airport data base – Aircraft Flight Tracking and Environmental Monitoring System (AFTEMS)], and aircraft runway use allocations. The future noise contours are based on the twenty-year Development Plan for the airport.

Computer Modeling. The DNL noise contours were generated using the Integrated Noise Model (INM) Version 6.0c, which is the most current computer program developed by the Federal Aviation Administration specifically for modeling the noise environment at airports. The INM program requires the input of the physical and operational characteristics of the airport. Physical characteristics include runway end coordinates, displaced thresholds, airport altitude, topography, and temperature. Operational characteristics include aircraft mix and flight tracks. Optional data that can be incorporated in the model includes approach and departure profiles, approach and departure procedures, and aircraft noise curves. Data from Paine Field's Aircraft Flight Tracking and Environmental Monitoring System (AFTEMS) was used to calculate the INM flight tracks and noise levels. Refinements in INM version 6.0c enhance its ability to

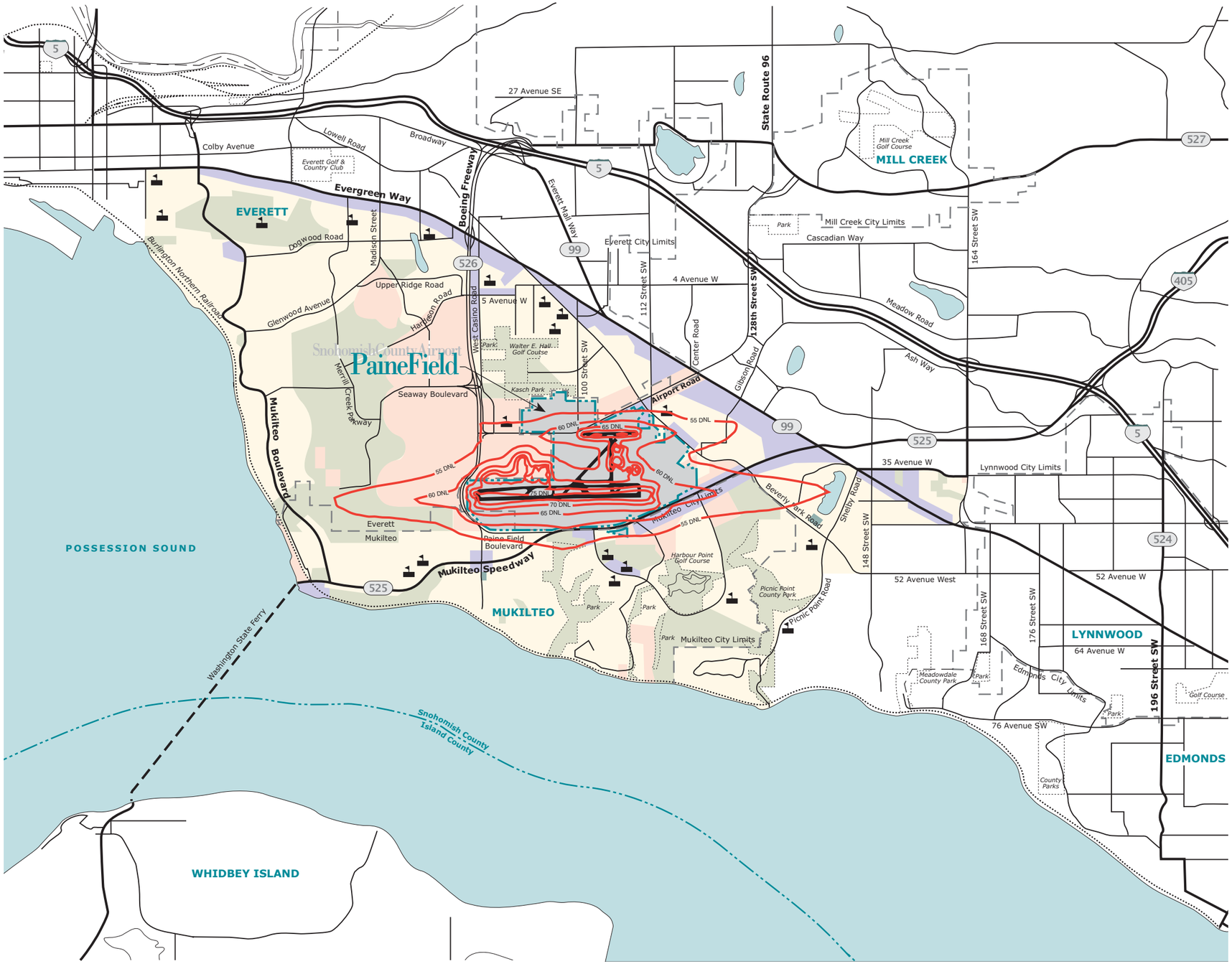


Figure D6

Existing (2000) Noise Contours & Generalized Existing Land Use

- Airport Property
- Residential
- Commercial
- Industrial/Office Park
- Undeveloped/Parks/Open Space
- Schools
- Outside of Study Area

1" = 6,000'

MASTER PLAN UPDATE

PaineField Snohomish County Airport

Source: **Snohomish County Planning Department Mapping, Aerial Photography, and United States Geological Survey (USGS) Quadrangle Sheets.** Existing Land Use: **Field Surveys.**

Figure D7

Future (2021) Noise Contours & Generalized Existing Land Use

- Airport Property
- Residential
- Commercial
- Industrial/Office Park
- Undeveloped/Parks/Open Space
- Schools
- Outside of Study Area

1" = 6,000'

MASTER PLAN UPDATE

Paine Field Snohomish County Airport

Source: **Snohomish County Planning Department Mapping, Aerial Photography, and United States Geological Survey (USGS) Quadrangle Sheets.** Existing Land Use: **Field Surveys.**

accurately predict noise impacts from aircraft engine run-ups and noise attenuation provided by terrain.

Federal Land Use Compatibility Guidelines. Establishing land use compatibility within airport environs is the responsibility of local authorities, but should be based on a recognized standard. Federal Aviation Regulations (FAR) Part 150 guidelines are the acknowledged standards by the federal government regarding aircraft generated noise at airports. These guidelines indicate that the 65 DNL noise contour is the threshold noise level for defining incompatible land uses [some noise sensitive land uses (e.g., residential, schools, hospitals, etc.) may be incompatible if located within a 65 or higher DNL noise contour area]. Please reference the 1996 *Paine Field FAR Part 150 Noise Study* for a comprehensive discussion and analysis of noise and land use compatibility issues specifically related to Paine Field.

Noise Contour Evaluation. Using the existing and forecast aircraft operation numbers presented earlier, noise contours have been generated and are presented in the proceeding illustrations. The 55, 60, 65, 70, and 75 DNL noise contours are illustrated on each map.

The existing 75 DNL noise contour contains approximately 144 acres, all within airport/Boeing Company property. The 70 DNL noise contour contains approximately 351 acres, also all contained within airport/Boeing Company property. The 65 DNL encompasses roughly 604 acres, all of which is contained on airport/Boeing Company property. The 60 DNL noise contour contains approximately 1,163 acres, while the existing 55 DNL contour contains approximately 2,563 acres. The 60 DNL noise contour extends off of airport property to the south of both parallel runways and to the north of the main runway. The 55 DNL noise contour extends off of airport property in all directions.

The number of aircraft operations used as the 2000 base year in this Master Plan Update noise contour was 223,192 (based on 213,371 counted by the FAA Airport Traffic Control tower between 7:00am and 9:00pm, and 9,821 estimated between 9:00pm and 7:00am). The new noise contours generated by the INM Version 6.0c provide a more accurate depiction of airport related noise due to refined model inputs from the airport's new Aircraft Flight Tracking Environmental Monitoring System (AFTEMS) and the upgraded capabilities of the newer INM model to present noise effects from engine run-ups at Goodrich and Boeing.

The future 75 DNL noise contour encompasses some 155 acres, while the 70 DNL contains approximately 378 acres, both of which are contained entirely within airport/Boeing Company property. The future 65 DNL noise contour contains approximately 682 acres, extending off of airport/Boeing company property only slightly

to the north of the main runway. The future 60 DNL noise contour contains approximately 1,465 acres and extends off of airport property to the south of both parallel runways, as well as to the north and slightly to the west of the main runway. The 55 DNL noise contour encompasses approximately 3,156 acres and extends off of airport property to the north, south, east, and west. The number of aircraft operations used as the 2021 future year in this Master Plan Update noise contour was 375,706 (based on projections of 359,176 when the FAA Airport Traffic Control tower is open between 7:00 am and 9:00pm, and 16,530 between 9:00pm and 7:00am).

With this information as background, Snohomish County will update the Existing and Future (five year) Noise Exposure Maps that were prepared as part of the 1996 FAR Part 150 Study. The Noise Exposure Maps are the "official" Federally recognized noise contour maps that local governments use when considering land use compatibility issues.

Air Quality. An air quality evaluation was performed to find out if a Clean Air Act general conformity determination would be required if the Master Plan Update's proposed projects during the first five year period are approved for construction. An emissions inventory was prepared and contrasted with the de-minimis levels for a maintenance area (the designation applied to Snohomish County as air quality has met the national ambient air quality standards subsequent to the non-attainment designation of the early 1990s). The *Air Quality Conformity Analysis* document is contained in the Appendix of this document and shows that the emissions from the proposed development projects are below the Clean Air Act defined de-minimis thresholds, indicating that no further analysis is required.

State

Snohomish County Airport will prepare and issue a non-project SEPA Determination of Nonsignificance (DNS) on the adoption of the Airport Master Plan and FAR Part 150 Noise Exposure Maps. Environmental effects of individual projects identified in this Master Plan Update will be subject of project specific environmental review and determinations at the time of each project permitting. During the Master Plan Update's draft report public review period comments were received suggesting that, even though the Master Plan does not provide specific drainage analysis or recommendations, it should identify the efforts the airport has undertaken to address surface water quality and quantity issues.

Surface Water Programs. Paine Field has an extensive system of water treatment, conveyance and detention facilities to deal with storm water. The airport sits on top of a plateau at 600' Above Mean Seal Level (AMSL) with airport storm water flowing toward Puget Sound through a number of drainages. Paine Field is the headwaters for creeks in the Big Gulch, Smugglers Gulch, Japanese Gulch, Swamp Creek, and Lake Stickney

basins. Nearly half of the airport's 1,284 acres flow into the Big Gulch basin. Comprehensive storm water detention plans have been developed and constructed utilizing a system of biofiltration fields, bioswales, oil water separators, regional detention ponds, wetlands, dikes, and valve control structures to protect water quality and control peak storm water flows leaving the airport into these basins. New facilities constructed on the Airport are designed in compliance with the County's drainage ordinance. In addition to multi-million dollar investments in these facilities, the airport provides funding for off-site surface water improvements through County Surface Water Management Program fees in excess of $100,000 per year. The airport is currently participating in studies with the City of Mukilteo and the Olympus Terrace Sewer District for the construction of a peak flow storm water bypass pipe down Big Gulch to address erosion issues in the creek.

Snohomish County Airport contains numerous wetlands ranging from very small (<100sf) "low" quality (category 3) to large (19 acre) "high" quality (category 1). The airport has undertaken an elaborate program to enhance and expand existing wetlands as advance mitigation for wetlands that will be impacted by future development on the airport. This Wetland Banking program includes on-site wetlands with "scrub-shrub" vegetation to minimize bird attraction for aircraft flight safety, and a large remote off-site wetland with "open water" elements providing a nature sanctuary for wildlife. The airport's wetland banking program has received numerous national, state, regional and local awards for finding a balance between environmental protection, airport development and aircraft safety (for more information on the airports wetland compensation efforts please visit painefield.com).

An Update to the Paine Field Airport Layout Plan set of drawings was produced during the Paine Field Intersection Study and Approved by the FAA on 11-21-14. Updated drawings include:

E1A – Airport Layout Data
E1B – Airport Layout Plan
E2 – Airport Airspace Plane Profile
E3 – Airport Airspace Runway 34l Plan Profiles
E4 – Inner Approach Runway 16R
E5 – Inner Approach Runway 34L
E6 – Inner Approach Runway 16L-34R
E7A – Inner Approach Runway 12-30
E7B – Departure Surface Runway 16R-34L

Airport Plans

Introduction

The plan for the future development of Paine Field has evolved from an analysis of many considerations. Among these are: aviation demand; aviation forecasts; capacity analysis; aircraft operational characteristics; facility requirements; environmental considerations; and as characterized in the previously noted statement of goals, the general direction or thrust of airport development as prescribed by the Snohomish County management and staff. Forecasts are utilized as a basis for planning; however, facilities are only to be constructed to meet actual demand. The Regional Low unconstrained forecast of aviation activity has been adopted by the FAA and Snohomish County. It is recognized that market constraints may limit demand for passenger service at Paine Field.

Previous chapters have established and quantified the future development needs of Paine Field. In this chapter, the various elements of the plan are categorically reviewed and detailed here in an outline and graphic format. A brief written description of the individual elements represented in the set of Airport Plans for Paine Field is accompanied by a graphic description presented in the form of the Airport Layout Plan, the Airspace Plan, the Inner Portion of the Approach Surface Drawings, the Terminal Area Plans, the Land Use Plan, and the Airport Property Map.

Airport Layout Plan

The Airport Layout Plan (ALP) is a graphic depiction of existing and ultimate airport facilities which will be required to enable the airport to properly accommodate the forecast future demand. In addition, the ALP also provides detailed information on both airport and runway design criteria, which is necessary to define relationships with applicable standards. The following illustration, entitled *AIRPORT LAYOUT PLAN,* and the following paragraphs describe the major components of the future airport development plan.

Runway System

The airport's basic runway configuration will be retained. The airport's primary north/south runway, Runway 16R/34L, will remain at its existing length and width (9,010' x 150'). The secondary parallel runway (Runway 16L/34R) will also remain at its existing length and width (3,000' x 75'). The crosswind runway (Runway 11/29), also programmed to be retained, has an existing length and width of 4,504' x 75', with a displacement of 799' of the northwest threshold.

Another important consideration related to runway development at Paine Field is the existing and planned instrument approach system.

- Runway 16R currently has CAT I ILS precision approach (200' ceiling and ½ mile visibility minimums) capabilities that will be maintained, as well as NDB and GPS non-precision approach capabilities. The current instrument approach capabilities will be supplemented with precision GPS capabilities when available, and in the long-term very low minimum instrument approach capabilities (CAT II) are programmed for Runway 16R.
- Runway 34L currently has non-precision approach capabilities with ¾ mile visibility minimums. However, it is anticipated that a precision approach with CAT I capabilities (200' ceiling and ½ mile visibility minimums) will eventually be established.
- Runways 16L/34R and 11/29 have visual approach capabilities that will continue to be maintained.

Land Acquisition. In association with the ability to accommodate additional landside facilities, three parcels of land are recommended for acquisition. The first is a 7.5-acre tract east of the Snohomish County Public Works Department and south of 100th St. S.W. The second is a 1-acre tract south of the IAC facility and north of the YMCA, north of 112th St. S.W. This purchase area encompasses the property surrounding the existing air guard facilities. The third parcel is a 3.2-acre tract between Beverly Park Road and 27th Ave W., just east of the 34R RPZ.

The airport should control the height of objects and land use within the RPZ areas. With regard to the future RPZ associated with improved approach capabilities to Runway 34L, this can be accomplished through acquisition of easements; however, the FAA recommends fee simple ownership.

Runway Approach Instrumentation and Lighting. In the short-term, the existing instrument approach capabilities to Runway 16R are to be maintained with the existing approach lighting system and ground based NAVAID system. In the long-term, if CAT II approach capabilities are accommodated, the approach lighting system associated

Figure E1A & E1B
CLICK TO VIEW
AIRPORT LAYOUT DATA
AIRPORT LAYOUT PLAN
(File Size Approximately 5,895 KB)

with Runway 16R will be improved with an Approach Lighting System with Sequenced Flashers - 2 (ALSF -2), replacing the existing Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR), along with the addition of touchdown zone lights, and a runway visual range (RVR) system. The existing Centerline Lights serving Runway 16R and the High Intensity Runway Light (HIRL) edge lighting serving Runway 16R/34L will be maintained.

Also in the long-term, GPS or ground-based instrument approach capabilities will be improved to provide precision instrument approach procedures to Runway 34L. The Medium Intensity Approach Lighting with Sequential Flashers (MALSF), currently in place for Runway 34L, are programmed to be upgraded to MALSR to coincide with the implementation of the precision instrument approach.

The visual approaches serving Runways 16L/34R and 11/29 will be maintained, along with the Medium Intensity Runway Lights (MIRL) serving these runways. The Visual Approach Slope Indicator (VASI) lights serving Runway 11/29 are recommended to be replaced with Precision Approach Path Indicators (PAPIs). Runway End Indicator Lights (REILs) currently exist on Runway 16L/34R and are programmed for Runway 11/29.

Taxiway System

The parallel taxiway systems serving all runways meet FAA standards for separation between runway centerline and taxiway centerline. A new parallel taxiway system (Taxiway W) on the southwest side of Runway 11/29 is programmed to connect Taxilane H with Taxilane E. In addition, several new exit/access taxiways are proposed for the main runway. On the west side of the main runway, Taxiways K-1 and K-3 are programmed. On the east side of the main runway, a new exit taxiway will be built between existing Taxiways A-2 and A-3.

Landside Development

As discussed in the previous chapter, *CONCEPTS, ALTERNATIVES AND DEVELOPMENT PLAN,* and as illustrated on the previously presented *AIRPORT LAYOUT PLAN*, areas for landside facilities are also allocated. For the purposes of the Master Plan Update, and to coincide with FAA planning terminology, landside facilities include aircraft storage aprons, hangars, industrial aviation facilities, terminal facilities, aviation maintenance facilities, automobile access and parking, support facilities, etc. Detailed descriptions of the landside development areas are provided in the *Area Plans* section of this chapter. As provided on the Airport Layout Plan, proposed landside development includes:

Central, Terminal, and North Ramps. This area is located between the parallel runways north of Runway 11/29. Because the area has excellent airside and landside access,

including adequate aircraft parking ramp, it is programmed to continue to accommodate many of the airport's general aviation, industrial and administrative facilities, along with the airport's passenger terminal facility. This area will accommodate new development related to airport administrative functions, passenger terminal facilities, and Aircraft Rescue and Fire Fighting (ARFF) facilities in the infield area northwest of the existing administrative offices. In addition, new general aviation development is programmed for the Central Ramp and North Ramp areas, and the north side of the Central Ramp is programmed to be redeveloped for aviation use.

West Ramp Area. This area is located between the parallel runways south of Runway 11/29 and north of Taxilane E. Existing facilities include general aviation hangars. Aviation use development/redevelopment is programmed for the east half of this area with the construction of additional general aviation hangars. Units for Design Group 2 aircraft will front on Taxilane E and the more northerly storage units are sized to accommodate Design Group 1 aircraft. Additionally, a parallel taxiway (Taxiway W) is programmed for the southwest side of Runway 11/29.

Bomarc Area. This area is located east of Runway 16L/34R and northeast of Airport Road/100th Street SW intersection. In addition to continued use of the area for Bomarc Business Park and related functions, the area south of 100th Street SW (currently containing Snohomish County Public Works facilities) is identified for commercial development.

As previously mentioned, a 7.5-acre parcel adjacent to, and east of the area containing the Snohomish County Public Works facilities south of 100th Street SW, is programmed for acquisition. To continue to ensure land use compatibility, this new parcel should be classified with an "airport compatible commercial/industrial use" designation.

East Ramp Area. The East Ramp Area is located east of Runway 16L/34R and currently contains several small airplane general aviation hangars. The portion of the area adjacent to the parallel taxiway on the east side of Runway 16L/34R, which is undeveloped, is designated for additional hangar/ramp development. The tract south of Minuteman Lane is designated for Airport Compatible Commercial/Industrial development.

South Ramp. This area is located between the parallel runways and south of Taxilane E. This area currently supports operations and activities associated with Goodrich Inc. Additional facilities associated with the south ramp include the Messerschmitt 262, the Department of Emergency Management, and the airport's ARFF/Maintenance facility. Future programming for this area involves new industrial aviation development/ redevelopment, and general aviation redevelopment. The south ramp has also been identified as the location on the airport that could accommodate a temporary use by large air cargo aircraft.

Goodrich Inc. Ramp. The Goodrich Inc. ramp is located south of the south ramp, adjacent to exit Taxiway A-8. This area accommodates those activities associated with the contract maintenance and upkeep of various large air carrier aircraft, such as Northwest Airlines, FedEx, UPS, and United Airlines. This type of use could be expanded to the south.

West Side-North. This area is located west of Runway 16R/34L, north of the RPZ associated with the approach to Runway 11. It has excellent potential for taxiway access and has been designated for aviation use facilities. For a ground lease, this area is currently subject to a Boeing Company first right of refusal. The portion of this area immediately adjacent to the Runway 11 RPZ will require substantial fills to achieve a runway accessible grade. The northern most portion of this area has been identified for commercial aviation/airport-related facilities including tour center, hotel, restaurant, and museum development.

West Side-South. This area is located west of Runway 16R/34L, south of the Runway 11 RPZ. The area immediately south of the Runway 11 RPZ contains a significant amount of topographic relief; therefore, development within this area may be limited to some extent. The area between the Runway 11 RPZ and Taxiway K-5 within 950 feet of the Runway 16R/34L centerline is programmed for aviation use facilities, as are the K-5 and K-6 areas generally within 1,500 feet of the Runway 16R/34L centerline. The area further west is programmed for airport compatible commercial/industrial development. The area south of Taxiways K-5 and K-6 is also programmed for airport compatible commercial/industrial development.

Programmed facilities within the various development areas are further detailed in the *Area Plans* section later in this chapter.

Airspace Plan

The *Airport Airspace Drawings* are based on Federal Aviation Regulations (FAR) Part 77, *Objects Affecting Navigable Airspace*. In order to protect the airport's airspace and approaches from hazards that could affect the safe and efficient operation of aircraft, federal criteria contained in FAR Part 77 have been established to provide guidance in controlling the height of objects in the vicinity of the airport. FAR Part 77 criteria specify a set of imaginary surfaces which, when penetrated, identify an object as being an obstruction. Objects are identified using the *Airport Obstruction Chart* published by the National Ocean Service (NOS) of the U.S. Department of Commerce in 1993. Even though the airport has an ongoing tree trimming program, some of the identified trees will have grown taller, while others, not identified in 1993, will have grown to the point where they are now obstructions. An updated NOS obstruction survey is programmed; however, the schedule for its production has not been established.

The *AIRPORT AIRSPACE PLAN AND PROFILE,* which is illustrated on the following page, provides a plan view which depicts these criteria as they specifically relate to Paine Field. The plan is based on the ultimate planned runway alignments and lengths, along with the ultimate planned approaches to those runways. Therefore, for Runway 16R/34L, it is based on larger-than-utility criteria, with an existing precision instrument approach to Runway 16R and a future precision instrument approach to Runway 34L. For Runway 16L/34R and Runway 11/29, it is based on visual approaches and utility runway criteria.

Inner Portion of the Approach Surface Drawings

To provide a more detailed view of the inner portions of the Part 77 imaginary approach surfaces and the Runway Protection Zone (RPZ) areas, the following drawings are provided. An RPZ is trapezoidal in shape, centered about the extended runway centerline, and typically begins 200 feet beyond the end of the runway. The RPZs are safety areas within which it is desirable to clear all objects (although some uses are normally acceptable). The size of the RPZ is a function of the design aircraft and the visibility minimums associated with the runway's instrument approach capabilities.

The *Inner Portion of the Approach Surface Drawings*, which are depicted on the following pages, provide large-scale drawings with both plan and profile delineations. They are intended to facilitate identification of the roadways, utility lines, railroads, structures, and other possible obstructions that may lie within the confines of the inner approach surface area associated with each runway end. As with the *Airport Airspace Drawings*, the *Inner Portion of the Approach Surface Drawings* are based upon the ultimate planned runway length, along with the ultimate planned approaches to each runway.

Figure E2
CLICK TO VIEW
AIRPORT AIRSPACE PLAN AND PROFILE
(File Size Approximately 2,169 KB)

Figure E3
CLICK TO VIEW
AIRPORT AIRSPACE PLAN – Runway 34L Plan and Profile
(File Size Approximately 2,169 KB)

Figure E4
CLICK TO VIEW
Inner Portion of Approach Surface Drawing – Runway 16R
(File Size Approximately 2,696 KB))

Figure E5
CLICK TO VIEW
Inner Portion of Approach Surface Drawing – Runway 34L
(File Size Approximately 2,819 KB)

Figure E6
CLICK TO VIEW
Inner Portion of Approach Surface Drawing – Runway 16L/34R
(File Size Approximately 1,994 KB)

Figure E7A & E7B
CLICK TO VIEW
Inner Portion of Approach Surface Drawing – Runway 12-30
Departure Surface Runway 16R-34L
(File Size Approximately 2,104 KB)

Terminal Area Plan

The following *Terminal Area Plan* illustrations, present detailed views of the most intensely developed landside use areas on the airport.

Central, Terminal, West and North Ramp Areas

This area is illustrated in the following figure entitled *TERMINAL AREA PLAN NORTH.* These areas are located between the parallel runways north of Taxilane E. The areas illustrated contain many existing airport functions including the airport's administrative offices, FBO facilities, storage hangars and apron, college facilities, museum of flight facilities, industrial aviation facilities, and corporate aviation facilities. The majority of these existing facilities will continue to function in their existing locations. With a focus on new development, the proposed development plan for this portion of the airport is described in the following paragraphs.

General Aviation Facilities. These areas will continue to serve as a center for general aviation activities at the airport. An important area for general aviation activity is the current general aviation terminal facility along with the Inner Terminal Ramp. The general aviation terminal and Inner Terminal Ramp accommodate the majority of the larger itinerant general aviation aircraft use. This type of activity is expected to increase in the future at Paine Field and providing related services should be a primary focus of facilities in the existing terminal area. Related services, which should be accommodated in the general aviation terminal area, could include a pilot lounge, meeting rooms, flight planning facilities, fueling services, rental car service, and other services that might be utilized in business aviation activities. A structure to house such facilities is programmed for the northeast end of the Inner Terminal Ramp, as is a westerly expansion of the paved ramp area.

Another important function related to general aviation activity relates to smaller general aviation aircraft and based aircraft. One site that is underutilized and slated for redevelopment at Paine Field is the site occupied by the airport's restaurant, along with buildings C-5, C-70 and C-71, in the central ramp area. This is a prime development area for activities that relate to based aircraft, such as Fixed Base Operator (FBO) facilities and aircraft storage/maintenance facilities, as well as a new restaurant facility. One of the primary reasons the Central Ramp area is attractive for new development, is the fact that the site provides the opportunity for a substantial amount of automobile parking. When redeveloped, this area will continue to support facilities for smaller general aviation aircraft (ADG 1).

Additional general aviation hangar development is also programmed for the north ramp and west ramp development areas. The north ramp area will continue to be developed

Figure E8
CLICK TO VIEW
Terminal Area Plan North
(File Size Approximately 5,286 KB)

for hangar facilities to accommodate medium to large general aviation aircraft, while the west ramp area will be utilized for small and medium sized general aviation aircraft.

In addition to the passenger terminal facility development area described above, there are two other undeveloped tracts that are identified for aviation use development. The first is located on the northeast end of the Inner Terminal Ramp, east of the new Air Traffic Control Tower (ATCT). This area, along with the Passenger Terminal Development area will be designed to accommodate the largest business jets and the small to medium size commercial passenger service aircraft [i.e., Gulfstream V, B-737, etc. (ADG 3)]. This area is programmed for the development of FBO/General Aviation Terminal facilities. The second is located in the northeast corner (the north ramp area). This tract will continue to be developed for hangar facilities to accommodate medium to large general aviation aircraft (ADG 2 aircraft).

Airport Administration/Passenger Terminal Facilities. The demand forecast for passenger terminal facilities at Paine Field can be accommodated on the undeveloped infield site northwest of the inner/outer terminal ramp area. The passenger terminal building will also accommodate the airport's administrative offices. In addition to the terminal building, the site will also provide an aircraft parking apron and automobile parking/access facilities to accommodate commercial passenger activity demands.

Air Traffic Control Tower (ATCT). The existing air traffic control tower is currently located on the west end of the Goodrich Inc. Hangar 2. Construction of a new ATCT is currently underway in the area adjacent to, and north of, the Inner Terminal Ramp.

Fuel Storage Facilities. The bulk of the airport's fuel storage capacity will be located in the North Ramp and Inner Terminal Ramp. The North Ramp facility contains six 60,000-gallon above ground storage tanks and one 20,000-gallon above ground storage tank, while the Inner Terminal ramp has one 2,000-gallon underground and three 10,000-gallon underground storage tanks. Much of the North Ramp fuel storage volume is required to accommodate fuel that is off-loaded from aircraft during maintenance.

Industrial Aviation Facilities. Currently, the industrial aviation facilities in this area are focused on the site southeast of the Inner Terminal Ramp, which contains the Goodrich Inc. Hangar 2, Precision Engines, Tyee Aircraft, and Umbra Cucinetti (UCI) facilities. It is expected that in the long-term the industrial aviation uses in this area will be shifted to other locations on the airport.

South Ramp Area

This area is illustrated in the following figure, entitled *SOUTH RAMP AREA*. It is located between the parallel runways south of Taxilane E and, among others, contains numerous

Figure E9
CLICK TO VIEW
South Ramp Area
(File Size Approximately 5,243 KB)

industrial aviation facilities (including Goodrich Inc.). Sites within the South Industrial area which are planned for development or redevelopment include:

Industrial Aviation Facilities. The South Ramp will continue to be utilized extensively for industrial aviation facilities. In addition to the continued use of Goodrich Hangars 1 and 3, industrial aviation redevelopment can take place in the vicinity of building 201 and 207 (formerly part of the U.S. Army Reserve lease area) and new industrial aviation facilities can be constructed on that portion of the former Navy Housing site, which is adjacent to Goodrich Hangar 3.

General Aviation Facilities. The site just west of the approach end of Runway 34R has been identified as a redevelopment site for general aviation facilities. This site can be provided with taxiway access and, if demands and economic considerations indicate feasibility, it should be redeveloped for small size general aviation aircraft (ADG 1). This redevelopment area currently contains non-aviation functions (facilities that do not require taxiway access).

Aircraft Rescue and Fire Fighting (ARFF) Facility and Airport Maintenance Facility. These functions are currently contained in Building 219 on the western edge of the South Ramp Area. Currently, this building creates some wing-tip clearance concerns for large aircraft on Taxiway A. The ARFF function is programmed to be relocated to a new building that will be located adjacent to the proposed administration/passenger terminal building. After the ARFF function is relocated, Building 219 will be razed and replaced with a new Airport Maintenance Facility.

Navy Housing Site. The South Ramp Area also contains the Navy Housing tract. As stated in the previous chapter, the Navy Housing tract is identified as a potential area to be utilized for "airport compatible commercial/industrial development". This will help ensure land use compatibility and provide an additional development area for aviation related functions. Additionally, that part of the Navy Housing area located just east of the Runway 34L RPZ can be provided with taxiway access from the southern end of Taxiway A, and is programmed for aviation use.

East Ramp Area

This area is illustrated in the following figure, entitled *EAST RAMP AREA*, and is located east of Runway 16L/34R. North of Minuteman Lane the area contains several general aviation storage hangars and FBO facilities. South of Minuteman Lane, the area contains a County solid waste transfer station, along with undeveloped land.

General Aviation Facilities. The East Ramp Area will continue to be developed as a center for general aviation activity. The northeastern side of the area is reserved for

Figure E10
CLICK TO VIEW
East Ramp Area
(File Size Approximately 5,295 KB)

commercial general aviation hangar structures (i.e., FBO hangars, maintenance hangars, etc.). The center portion, which is currently undeveloped, will most likely be utilized for additional aircraft parking apron and additional FBO facilities.

Airport Compatible Commercial/Industrial. The East Ramp Area also has two undeveloped sites designated for non-aviation commercial/industrial facilities. The first is located south of 112th Street SW and is separated from the remainder of airport property by the Runway 34 RPZ and by the Air National Guard facilities, thereby making taxiway access impractical.

The second site is located along Airport Road, around the Minuteman Lane Intersection. This area is adjacent to the solid waste transfer station and, because of its location with frontage on Airport Road and Minuteman Lane, has significant potential for commercial uses (e.g., offices, retail, etc.) or airport compatible industrial activity.

Land Use Plan

The *LAND USE PLAN,* presented in the following figure, depicts existing and recommended use of all land within the ultimate airport property line and in the vicinity of the airport (including the area contained in the future 65 DNL noise contour). The purpose of the Land Use Plan is to provide airport management a plan for leasing revenue-producing areas on the airport. It also provides guidance to local authorities for establishing appropriate land use zoning in the vicinity of the airport.

Airport Property Map

The *AIRPORT PROPERTY MAP,* which is presented in a following illustration, indicates how various tracts of land within the airport boundaries were acquired (e.g., Federal funds, surplus property, local funds, etc.). The purpose of the Airport Property Map is to provide information for analyzing the current and future aeronautical use of land acquired with Federal funds.

Figure E11
CLICK TO VIEW
Land Use Plan
(File Size Approximately 863 KB)

Figure E12
CLICK TO VIEW
Airport Property Map
(File Size Approximately 671 KB)

Development Program

Introduction

The improvements necessary to efficiently accommodate the forecast aviation demands for Paine Field have been placed into three phases: phase one (0-5 years), phase two (6-10 years), and phase three (11-20 years). The proposed improvements are illustrated graphically by time period on the *PHASING PLAN* (see Figure F1), along with the project cost estimates that are presented on the following pages.

Implementation Schedule and Project List

A list of proactive capital improvement projects has been assembled from the facility requirements documentation previously presented. The project list has been coordinated with the Airport Layout Plan drawing set and the Capital Improvement Program that is periodically updated by airport management and the Federal Aviation Administration. The projects for the first five years are listed in priority order by year. In second and third phases (years 6-20) the projects are listed in priority order without year designators. Paine Field's phased capital improvement program, entitled *DEVELOPMENT PLAN PROJECT COSTS,* is presented as Tables F1, F2, and F3 of this chapter. It is anticipated that the project phasing will invariably alter as local and federal priorities evolve over the coming months and years.

The details of the Development Program, including a capital improvement project list, project cost estimates, a finalized phasing list, and a financial feasibility analysis have been formulated in consideration of comments received from airport staff, the FAA, and the Study Advisory Committee.

This Development Program is sound in terms of identifying capital improvement items that are likely to be needed to accommodate forecast demand. In reality, the Development Program represents a series of choices and alternatives for the airport. By preparing a comprehensive list of development possibilities (as detailed in the Development Plan Project Costs tables), the County will be able to program facility

Table F1
PHASE I (0-5 YEARS) DEVELOPMENT PLAN PROJECT COSTS
Paine Field Master Plan Update

Project Description	Note	Total Costs	Recommended Financing Method		
			Sponsor a)	Private b)	Federal c)
Year 1 (FFY 2002)	e)				
A.1 Construct Taxiway "W"		$1,000,000	$100,000	$0	$900,000
A.2 Construct West Ramp Hangars (Including Taxilanes) - Phase I		$5,000,000	$3,900,000	$0	$1,100,000
A.3 Install Sanitary Sewer to Serve Northwest Area		$350,000	$350,000	$0	$0
A.4 Security Fencing		$150,000	$15,000	$0	$135,000
A.5 Removal of Airspace Obstructions		$100,000	$100,000	$0	$0
A.6 Pavement Maintenance		$200,000	$200,000	$0	$0
YEAR 1 TOTAL		**$6,800,000**	**$4,665,000**	**$0**	**$2,135,000**
Year 2 (FFY 2003)	e)				
A.7 Terminal Planning		$200,000	$20,000	$0	$180,000
A.8 Expand Inner/Outer Terminal Ramp		$2,050,000	$205,000	$0	$1,845,000
A.9 Install Aircraft Run-Up Area at Taxiway "A-4"		$55,000	$5,500	$0	$49,500
A.10 National Flight Interpretive Center		$16,500,000	$1,500,000	$15,000,000	$0
A.11 Upgrade Runway/Taxiway Lighting		$1,800,000	$180,000	$0	$1,620,000
A.12 Security Fencing		$150,000	$15,000	$0	$135,000
A.13 Security Lighting		$100,000	$10,000	$0	$90,000
A.14 Removal of Airspace Obstructions		$100,000	$10,000	$0	$90,000
A.15 Pavement Maintenance		$200,000	$200,000	$0	$0
A.16 National Guard Land Swap (3 Acre Parcel Between 27th Ave. W and Beverly Edmonds Road)		$0	$0	$0	$0
YEAR 2 TOTAL		**$21,155,000**	**$2,145,500**	**$15,000,000**	**$4,009,500**
Year 3 (FFY 2004)	e)				
A.17 Construct East Ramp		$515,000	$51,500	$0	$463,500
A.18 Rehabilitate Runway 16L/34R - Overlay		$1,025,000	$102,500	$0	$922,500
A.19 Install Sewer Line K5/K6 Ramp Area		$245,000	$147,000	$98,000	$0
A.20 Airspace Obstruction Removal		$100,000	$10,000	$0	$90,000
A.21 Pavement Maintenance		$200,000	$200,000	$0	$0
A.22 Construct Taxiway "K-1"		$950,000	$95,000	$0	$855,000
YEAR 3 TOTAL		**$3,035,000**	**$606,000**	**$98,000**	**$2,331,000**
Year 4 (FFY 2005)	e)				
A.23 South Ramp Rehabilitation		$2,000,000	$200,000	$0	$1,800,000
A.24 Construct Access - West Side Corporate Hangar Area		$560,000	$560,000	$0	$0
A.25 Utilities - West Side Corporate Hangar Area - K5/K6		$185,000	$18,500	$0	$166,500
A.26 Northwest Area Drainage		$8,000,000	$800,000	$0	$7,200,000
A.27 Rehabilitate Central Ramp		$1,150,000	$115,000	$0	$1,035,000
A.28 Site Preparation for North Ramp Hangar Area		$2,300,000	$230,000	$0	$2,070,000
A.29 Construct Corporate FBO Terminal		$1,500,000	$150,000	$1,350,000	$0
A.30 Pavement Maintenance		$200,000	$20,000	$0	$180,000
YEAR 4 TOTAL		**$15,895,000**	**$2,093,500**	**$1,350,000**	**$12,451,500**

Notes

Cost estimates, based upon 2002 data, are intended for preliminary planning purposes and do not reflect a detailed engineering evaluation.

a) Sponsor Funding - Current revenues, cash reserves, bonds, etc.
b) Private Funding - subject to developer, tenant, or revenue bond financing.
c) FAA AIP (Airport Improvement Program) - Unless Otherwise Noted
d) 100% FAA F&E Funding - no costs listed
e) FFY - Federal Fiscal Year [October 1 through September 30 (i.e., FFY 2002 is October 1, 2001 through September 30, 2002)]

Table F1 (Continued)
PHASE I (0-5 YEARS) DEVELOPMENT PLAN PROJECT COSTS
Paine Field Master Plan Update

Project Description	Note	Total Costs	Recommended Financing Method Local a)	Private b)	Federal c)
Year 5 (FFY 2006)	e)				
A.31 Purchase New Snowblower		$350,000	$35,000	$0	$315,000
A.32 South Side Grading - Northwest Area		$1,200,000	$1,200,000	$0	$0
A.33 Construct East Ramp Aviation Center		$1,500,000	$150,000	$1,350,000	$0
A.34 Construct Phase I West Side Commercial Area - South		$5,000,000	$500,000	$4,500,000	$0
A.35 North Ramp Hangar Development - Phase II		$6,250,000	$625,000	$5,625,000	$0
A.36 Construct K5/K6 Ramp Area		$2,000,000	$200,000	$0	$1,800,000
A.37 Construct K5/K6 Hangars		$10,000,000	$1,000,000	$9,000,000	$0
A.38 Pavement Maintenance		$200,000	$200,000	$0	$0
YEAR 5 TOTAL		**$26,500,000**	**$3,910,000**	**$20,475,000**	**$2,115,000**
Sub-Total/Phase I		**$73,385,000**	**$13,420,000**	**$36,923,000**	**$23,042,000**

Notes

Cost estimates, based upon 2002 data, are intended for preliminary planning purposes and do not reflect a detailed engineering evaluation.

a) Sponsor Funding - Current revenues, cash reserves, bonds, etc.

b) Private Funding - subject to developer, tenant, or revenue bond financing.

c) FAA AIP (Airport Improvement Program) - Unless Otherwise Noted

d) 100% FAA F&E Funding - no costs listed

e) FFY - Federal Fiscal Year [October 1 through September 30 (i.e., FFY 2002 is October 1, 2001 through September 30, 2002)]

Table F2

PHASE II (6-10 YEARS, FFY 2007 through 2011) DEVELOPMENT PLAN PROJECT COSTS (see note e)

Paine Field Master Plan Update

	Project Description	Note	Total Costs	Recommended Financing Method Sponsor a)	Private b)	Federal c)
B.1	Construct West Ramp Hangars (Including Taxilanes) - Phase II		$3,500,000	$3,325,000	$0	$175,000
B.2	Purchase ARFF Vehicle		$650,000	$65,000	$0	$585,000
B.3	Construct new ARFF Facility		$2,000,000	$200,000	$0	$1,800,000
B.4	Construct Taxiway "A-2.5"		$1,050,000	$105,000	$0	$945,000
B.5	Construct Taxiway "K-2.5"		$1,000,000	$100,000	$0	$900,000
B.6	Improved Non-Precision Approach to Runway 34L	d)	$0	$0	$0	$0
B.7	Utility Improvements for ARFF and Passenger Terminal		$120,000	$12,000	$0	$108,000
B.8	Redevelop Navy Housing Property - Phase I		$30,000,000	$3,000,000	$27,000,000	$0
B.9	Construct Administration/Passenger Terminal		$9,800,000	$4,900,000	$0	$4,900,000
B.10	Improve 100th St. SW/Terminal Access		$800,000	$80,000	$0	$720,000
B.11	Construct New Terminal Ramp		$2,650,000	$265,000	$0	$2,385,000
B.12	Administration/Passenger Terminal Parking		$3,400,000	$340,000	$0	$3,060,000
B.13	Security Fencing		$150,000	$15,000	$0	$135,000
B.14	Security Lighting		$100,000	$10,000	$0	$90,000
B.15	Airspace Obstruction Removal		$100,000	$10,000	$0	$90,000
B.16	Construct Airport Maintenance Facility		$1,900,000	$190,000	$0	$1,710,000
B.17	West Side Commercial Area - Central		$30,000,000	$3,000,000	$27,000,000	$0
B.18	Construct "K5/6" Ramp Area		$2,000,000	$200,000	$0	$1,800,000
B.19	Construct "K5/6" Hangars		$10,000,000	$1,000,000	$9,000,000	$0
B.20	112th St. SW Rehabilitation		$860,000	$860,000	$0	$0
B.21	112th St. SW Commercial/Business Development		$3,000,000	$300,000	$2,700,000	$0
B.22	Pavement Rehab (Average Cost Times 5 Years)		$1,000,000	$1,000,000	$0	$0
B.23	Purchase 7.5 Acres East of Public Works Facility		$1,300,000	$1,300,000	$0	$0
B.24	Purchase 1-Acre Parcel Associated with Air Guard		$260,000	$26,000	$0	$234,000
B.25	Construct Phase II West Side Commercial Area - South		$5,000,000	$500,000	$4,500,000	$0
	Sub-Total/Phase II		**$110,640,000**	**$20,803,000**	**$70,200,000**	**$19,637,000**

Notes

Cost estimates, based upon 2002 data, are intended for preliminary planning purposes and do not reflect a detailed engineering evaluation.

a) Sponsor Funding - Current revenues, cash reserves, bonds, etc.

b) Private Funding - subject to developer, tenant, or revenue bond financing.

c) FAA AIP (Airport Improvement Program) - Unless Otherwise Noted

d) 100% FAA F&E Funding - no costs listed

e) FFY - Federal Fiscal Year [October 1 through September 30 (i.e., FFY 2002 is October 1, 2001 through September 30, 2002)]

Table F3

PHASE III (11-20 YEARS, FFY 2012 through 2021) DEVELOPMENT PLAN PROJECT COSTS (see note e)

Paine Field Master Plan Update

	Project Description	Note	Total Costs	Recommended Financing Method Sponsor a)	Private b)	Federal c)
C.1	Redevelopment of Navy Housing Property - Phase II		$30,000,000	$3,000,000	$27,000,000	$0
C.2	Overlay Runway 16R/34L		$5,200,000	$520,000	$0	$4,680,000
C.3	Rehabilitate South Ramp		$3,000,000	$300,000	$0	$2,700,000
C.4	Construct "K5/6" Ramp Area		$2,000,000	$200,000	$0	$1,800,000
C.5	Construct "K5/6" Hangars		$10,000,000	$1,000,000	$9,000,000	$0
C.6	Airspace Obstruction Removal		$100,000	$10,000	$0	$90,000
C.7	Pavement Rehab (Average Cost Times 10 Years)		$2,000,000	$2,000,000	$0	$0
C.8	Land/Easements - R/W 34L Precision Approach RPZ		$8,000,000	$800,000	$0	$7,200,000
C.9	Replace VASI with PAPI	d)	$0	$0	$0	$0
	Sub-Total/Phase III		**$60,300,000**	**$7,830,000**	**$36,000,000**	**$16,470,000**
	GRAND TOTALS		**$244,325,000**	**$42,053,000**	**$143,123,000**	**$59,149,000**

Notes

Cost estimates, based upon 2002 data, are intended for preliminary planning purposes and do not reflect a detailed engineering evaluation.

a) Sponsor Funding - Current revenues, cash reserves, bonds, etc.

b) Private Funding - subject to developer, tenant, or revenue bond financing.

c) FAA AIP (Airport Improvement Program) - Unless Otherwise Noted

d) 100% FAA F&E Funding - no costs listed

e) FFY - Federal Fiscal Year [October 1 through September 30 (i.e., FFY 2002 is October 1, 2001 through September 30, 2002)]

improvements to meet demands, while also responding to financial realities and select development items that are in harmony with current development needs. To keep from being short-sighted in its development strategy for the airport, and to be fiscally responsible, the county may choose to selectively implement the capital items.

Cost Estimates

Cost estimates for individual projects, based on current dollars, have been prepared for the improvement projects that have been identified as potentially needed during the 20-year planning period. Facility costs have been formulated using unit prices extended by the size of the particular facility and tempered with specific considerations related to the region, the airport, and the development site. That being said, these estimates are intended to be used for planning purposes only and should not be construed as construction cost estimates, which can only be compiled following the preparation of detailed engineering design documents. It is strongly recommended that the County should refine the cost estimates for major capital projects (e.g., National Flight Interpretive Center, K5/K6 hangars, the new ARFF facility, the redevelopment of the Navy Housing Area, the passenger terminal, etc.) with detailed conceptual development documentation as soon as practicle.

Capital Improvement Program (CIP)

To assist in preparation of the FAA's effort to provide grant funding to the most needed projects, airport staff keeps on file and up to date with the FAA, a capital improvement project list. The projects and costs provided in the previously presented table, entitled *PHASE I (0 to 5 YEARS) DEVELOPMENT PLAN PROJECT COSTS*, have been organized by year, in a format similar to that used by the FAA. The projects, phasing, and costs presented in this Master Plan Update are the best projections that can be made at the time of formulation. The purpose of the project list, phasing, and costs listed here is to provide a progressive projection of capital needs, which can then be utilized in local and federal financial programming. It is realized that as soon as this long-range planning document is published, the project list starts to be out of date and; therefore, it will always differ to some degree with the airport's 5-year CIP on file with the FAA.

Phasing Plan

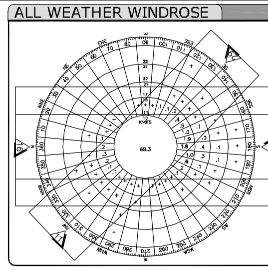
To supplement the information provided by the project list and project cost estimates, an illustration has been prepared. This graphic, entitled *PHASING PLAN,* indicates the suggested phasing for improvement projects throughout the 20-year planning period.

RUNWAY DATA

	RUNWAY 16R/34L		RUNWAY 16L/34R		RUNWAY 11/29	
	EXISTING	*FUTURE*	EXISTING	*FUTURE*	EXISTING	*FUTURE*
APPROACH VISIBILITY MINIMUMS	<1/2MILE/<3/4MILE	*<1/2MILE/<1/2MILE*	VISUAL/VISUAL	*VISUAL/VISUAL*	VISUAL/VISUAL	*VISUAL/VISUAL*
FAR PART 77 APPROACH SLOPE	50:1/34:1	*50:1/50:1*	20:1/20:1	*20:1/20:1*	20:1/20:1	*20:1/20:1*
RUNWAY WIDTH X LENGTH	150' X 9010'	*150' X 9010'*	75' X 3000'	*75' X 3000'*	75' X 4514'	*75' X 4514'*
PAVEMENT TYPE	ASPHALT/CONCRETE	*ASPHALT/CONCRETE*	ASPHALT	*ASPHALT*	ASPHALT	*ASPHALT*
PAVEMENT STRENGTH (IN 1000 LBS.)	830 DDT	*830 DDT*	12.5 S	*12.5 S*	30 S	*30 S*
RUNWAY LIGHTING	HIRL (℄ 16R)	*HIRL (℄ 16R)*	MIRL	*MIRL*	MIRL	*MIRL*
EFFECTIVE RUNWAY GRADIENT %	0.28	*0.28*	0.33	*0.33*	0.93	*0.93*
RUNWAY LINE-OF-SITE	CRITERIA MET	*CRITERIA MET*	CRITERIA MET	*CRITERIA MET*	CRITERIA MET	*CRITERIA MET*
WIND COVERAGE % (20 KNOTS)	99.5	*99.5*	99.5	*96.5*	96.5	*99.5*
VISUAL APPROACH AIDS	MALSR,PAPI/MALSF	*MALSR,PAPI/MALSR,PAPI*	REILS,PAPI	*REILS, PAPI*	VASI	*VASI,REILS*
INSTRUMENT APPROACH AIDS	NDB,DME,VOR,ILS,GPS/GPS	*NDB,DME,VOR,ILS,GPS/GPS*	NONE	*NONE*	NONE	*NONE*
AIRPORT REFERENCE CODE	D-V	*D-V*	B-I	*B-I*	B-I	*B-I*
CRITICAL AIRCRAFT	B-747-400	*B-747-400*	KING AIR B100	*KING AIR B100*	KING AIR B100	*KING AIR B100*
RUNWAY SAFETY AREA DIMENSIONS	500' X 11010'	*500' X 11010'*	120' X 3480'	*120' X 3480'*	120' X 4994'	*120' X 4994'*
RUNWAY OBJECT FREE AREA DIMENSIONS	800' X 11010'	*800' X 11010'*	250' X 3480'	*250' X 3480'*	250' X 4994'	*250' X 4994'*
OBSTACLE FREE ZONE CRITERIA	CRITERIA MET	*CRITERIA MET*	CRITERIA MET	*CRITERIA MET*	CRITERIA MET	*CRITERIA MET*
RUNWAY END COORDINATES	LAT. 47°55'16.8044"N LON. 122°17'09.0677"W / LAT. 47°53'47.8981"N LON. 122°17'07.0938"W	*LAT. 47°55'16.8044"N LON. 122°17'09.0677"W / LAT. 47°53'47.8981"N LON. 122°17'07.0938"W*	LAT. 47°54'23.11955"N LON. 122°16'18.09758"W / LAT. 47°53'53.51453"N LON. 122°16'17.76990"W	*LAT. 47°54'23.11955"N LON. 122°16'18.09758"W / LAT. 47°53'53.51453"N LON. 122°16'17.76990"W*	LAT. 47°54'37.47897"N LON. 122°17'12.35049"W / LAT. 47°54'06.53753"N LON. 122°16'24.93300"W	*LAT. 47°54'37.47897"N LON. 122°17'12.35049"W / LAT. 47°54'06.53753"N LON. 122°16'24.93300"W*
RUNWAY ELEVATIONS END	562.86'/577.50'	*562.86'/577.50'*	601.03/599.88	*601.03/599.88*	564.98'/603.81'	*564.98'/603.81'*
HIGH POINT	583.5'	*583.5'*	609.6'	*609.6'*	607.63'	*607.63'*
LOW POINT	562.86'	*562.86'*	599.88'	*599.88'*	564.94'	*564.94'*
TOUCHDOWN ZONE ELEVATION	579.85'/570.27'	*579.85'/570.27'*	604.1'/600.9'	*604.1'/600.9'*	588.9'/607.5'	*588.9'/607.5'*
DECLARED DISTANCES TORA	9010'/9010'	*9010'/9010'*	3000'/3000'	*3000'/3000'*	4514'/4514'	*4514'/4514'*
TODA	9010'/9010'	*9010'/9010'*	3000'/3000'	*3000'/3000'*	4514'/4514'	*4514'/4514'*
ASDA	9010'/8480'	*9010'/9010'*	3000'/3000'	*3000'/3000'*	4514'/4444'	*4514'/4514'*
LDA	9010'/9010'	*9010'/9010'*	3000'/3000'	*3000'/3000'*	3715'/4444'	*3715'/4514'*
DISPLACED THRESHOLD COORDINATES					LAT. 47°54'31.98808"N LON. 122°17'03.94160"W	
DISPLACED THRESHOLD ELEVATION					576.99'	*576.99'*

NOTES: 1. This drawing reflects current planning standards applicable to Paine Field Airport to the greatest extent possible. This drawing should not be used as a standard for planning or design.
2. Runway End and Airport Reference Point Lat./Long. coordinate data is NAD83/91. Runway elevation vertical datum NAVD 88.

ALL WEATHER WINDROSE

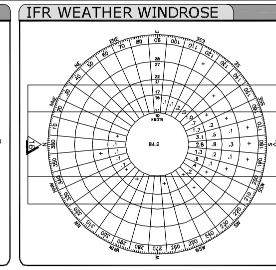


ALL WEATHER WIND ROSE

SOURCE: NATIONAL OCEANIC AND ATMOSPHEREIC ADMINISTRATION
STATION 24203 - PAINE FIELD, EVERETT, WASHINGTON
PERIOD OF RECORD - 1964-1967

RUNWAY	% COVERAGE	KNOTS
16/34	99.5	10.5
16/34	100.0	20
11/29	96.5	10.5

IFR WEATHER WINDROSE



IFR WIND ROSE

SOURCE: NATIONAL OCEANIC AND ATMOSPHEREIC ADMINISTRATION
STATION 24203 - PAINE FIELD, EVERETT, WASHINGTON
PERIOD OF RECORD - 1964-1967

CEILING LESS THAN 1,000 FEET AND/OR VISIBILITY LESS THAN THREE MILES BUT CEILING GREATER THAN OR EQUAL TO 200 FEET AND VISIBILITY GREATER THAN OR EQUAL TO 1/2 MILE.

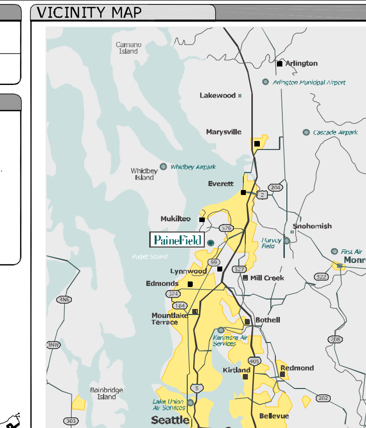
SPONSOR APPROVAL

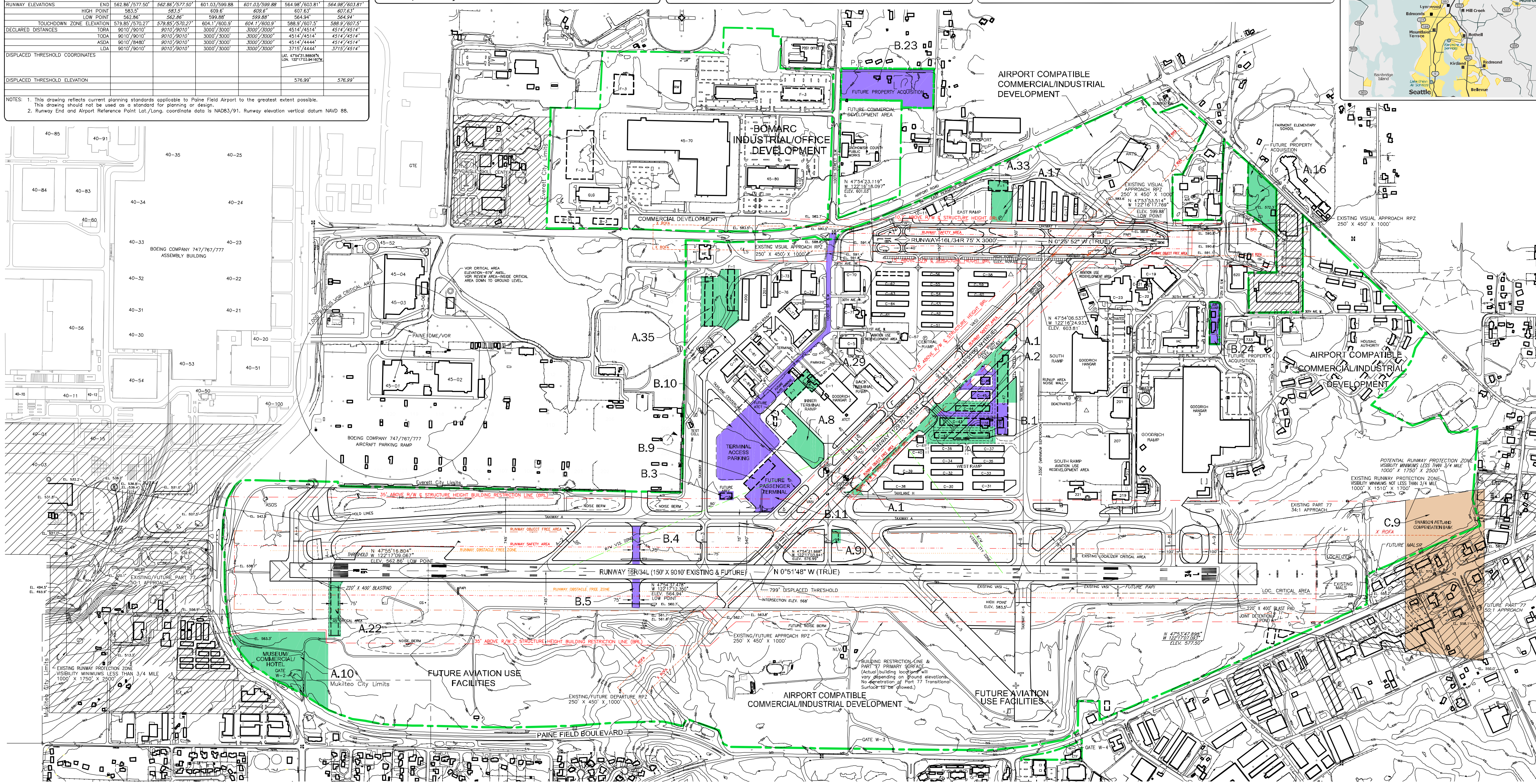
NAME-TITLE DATE

NOTES

1. THIS DRAWING IS FOR PLANNING AND DESIGN ONLY AND IS NOT INTENDED FOR ENGINEERING PURPOSES.
2. ALL LAT./LON. COORDINATE DATA IS NAD83.
3. PHOTOGRAMMETRIC MAPPING BY WALKER AND ASSOCIATES, SEATTLE, WA. PREPARED FOR SNOHOMISH COUNTY AIRPORT, JUNE 1998, (1" = 100' MAP ACCURACY). AERIAL PHOTOS DATED MAY 15, 2001.
4. DIGITAL FILE HORIZONTAL COORDINATE SYSTEM IS WASHINGTON STATE PLANE, NORTH ZONE 1983/1991 ADJUSTED, VERTICAL NAVD 88.

VICINITY MAP





NON-STANDARD CONDITIONS

DESCRIPTION	ARC EXISTING	ARC *FUTURE*	STANDARD EXISTING	STANDARD *FUTURE*	NON-STANDARD EXISTING	NON-STANDARD *FUTURE*	REMARKS
RUNWAY OBJECT FREE AREA BEYOND R/W 11 THRESHOLD	B-I (SMALL A/C)		250' X 300'	*250' X 300'*	CROSSED BY PERIMETER ROAD	*CROSSED BY PERIMETER ROAD*	
RUNWAY VISIBLITY ZONE					HANGAR ENCROACHMENT	*HANGAR ENCROACHMENT*	HANGARS TO BE REMOVED AT THE END OF THEIR USEFUL LIFE

BUILDING LEGEND

NO.	DESCRIPTION	NO.	DESCRIPTION	NO.	DESCRIPTION	NO.	DESCRIPTION
B-3-5	BOMARC BUSINESS PARK	C-47	*FUTURE T-HANGARS*	126	TO BE REMOVED	ETF	EVALUATION & TREATMENT FACILITY
C-1	GOODRICH/PRECISION ENGINES/AIRPORT OFFICES	C-51-56	T-HANGARS	201	GOODRICH	ATCT	AIR TRAFFIC CONTROL TOWER
C-2	G. A. TERMINAL/FLITELINE SERVICES	C-57	JET DECK RESTAURANT (TO BE REMOVED)	207	VACANT	LS	LIFT STATION
C-3	NORTHWAY AVIATION/CANNON INTERIORS	C-58-64	T-HANGARS	211	DEPT OF EMERGENCY MANAGEMENT	733	YMCA
C-4	FLITELINE SERVICES (TO BE REMOVED)	C-70	UMBRA CUSCINETTI	219	ARFF/MAINTENANCE	ME	MEDICAL EXAMINER
C-11	CROWN AVIATION	C-71	TYEE	221	ME 262 PROJECT	GLG	GOODRICH LANDING GEAR
C-13-18	T-HANGARS (EAST CONDO)	C-72	MUSUEM OF FLIGHT	620	GOODRICH (TO BE REMOVED)	RW	ROADWAY
C-19-23	NEUVANT	C-73	MUSEUM OF FLIGHT	1103	GOODRICH	NLV	NIGHT LIGHTING VAULT
C-30-31	WEST CONDO HANGARS	C-74	HANGAR	1105	VACANT (TO BE REMOVED)		
C-38-41	WEST CONDO HANGARS	C-75	HANGAR	1116	FIRE VEHICLE MAINTENANCE (TO BE REMOVED)		
C-32-37	T-HANGARS	C-77	RANGER CORP.	1200	T-HANGAR		
C-42	*FUTURE T-HANGARS*	C-78	HONEYWELL	1201	T-HANGAR	F-1	*FUTURE GA HANGAR*
C-43	*FUTURE T-HANGARS*	C-80,81	EVERETT COMMUNITY COLLEGE	40-01	BOEING COMPANY (40-01 THRU 45-04)	F-2	*FUTURE GA HANGAR & RESTAURANT*
C-44	*FUTURE T-HANGARS*	C-82	EVERETT COMMUNITY COLLEGE	45-70	BOEING COMPANY	F-3	*FUTURE BOMARC BUILDING*
C-45	*FUTURE T-HANGARS*	C-84	ATTWS	45-80	BOEING COMPANY	F-5	*FUTURE INDUSTRIAL HANGAR*
C-46	*FUTURE T-HANGARS*					F-7	*FUTURE GA TERMINAL*

REVISIONS

	DATE

AIRPORT DATA

	EXISTING	*FUTURE*
AIRPORT ELEVATION (AMSL)	609.65'	*609.65'*
AIRPORT REFERENCE POINT (ARP)	LAT. 47° 54' 25.388" N LON. 122° 16' 53.816" W	*LAT. 47° 54' 25.388" N LON. 122° 16' 53.816" W*
AIRPORT REFERENCE CODE	D-V	*D-V*
NPIAS CATEGORY	RELIEVER	*RELIEVER*
MEAN MAX. TEMPERATURE (HOTTEST MONTH)	73°	*73°*
TAXIWAY LIGHTING	MITL	*MITL*
TAXIWAY MARKING	CENTERLINE	*CENTERLINE*
AIRPORT PROERTY (ACRES)	1284.3	*1296.3*
UNICOM (MHz)	122.95	*122.95*
CONTROL TOWER (MHz) WEST	132.95	*132.95*
EAST	120.2	*120.2*

LAYOUT PLAN LEGEND

	EXISTING	*FUTURE*
AIRPORT PROPERTY LINE		
AIRPORT SECURITY FENCE		
AIRPORT BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
AVIGATION EASEMENT		
BUILDING RESTRICTION LINE	BRL	*BRL*
RUNWAY SAFETY AREA		
RUNWAY OBJECT FREE AREA		
FUEL STORAGE AREA	F	F
AIRPORT BEACON		
LIGHTED WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		
WASH RACK		

Figure F1 Phasing Plan

Phasing Legend
- Phase I
- Phase II
- Phase III

Prepared by:
Barnard Dunkelberg & Company
1616 East 15th Street
Tulsa, Oklahoma 74120
918.585.8844 staff@bd-c.com

Plotted: Dec 11, 2003 2:55pm

GRAPHIC SCALE IN FEET (0, 200', 400', 800', 1200')

Phasing Plan
SHEET 1 OF 12
DECEMBER, 2002

Paine Field
Snohomish County, Washington

This plan represents a suggested schedule and variance from it may be necessary, especially during the latter time periods. Attention has been given to the first five years because the projects outlined in this time frame include many critical improvements. The demand for certain facilities, especially in the latter time frame, and the economic feasibility of their development are to be the prime factors influencing the timing of individual project construction. Care must be taken to provide for adequate lead-time for detailed planning and construction of facilities in order to meet aviation demands. It is also important to minimize the disruptive scheduling where a portion of the facility may become inoperative due to construction and to prevent extra costs resulting from improper project scheduling.

Financial Plan and Implementation Strategy

Funding sources for the capital improvement program depend on many factors, including Airport Improvement Program (AIP) project eligibility, the ultimate type and use of facilities to be developed, debt capacity of the airport, the availability of other financing sources, and the priorities for scheduling project completion. For planning purposes, assumptions were made related to the funding source of each capital improvement. The projects costs provided in the Development Plan Project tables are identified with likely funding sources.

Sources of Capital Funding

AIP Entitlement Grants. The Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21), enacted in April 2000, established the first-ever Non Primary Airports Entitlement Program. AIR-21 sets aside grant funding for general aviation airports listed in the National Plan of Integrated Airport Systems (NIPAS) for pavement maintenance work. General aviation airports can each receive up to $150,000 per year based on FAA's assessment of maintenance needs over a five-year period. This funding set-aside is available for each federal fiscal year (2001-2003) when Congress appropriates at least $3.2 billion for FAA's AIP grant program. For the convenience of the airport sponsor, if a project is anticipated to cost in excess of $150,000, the participating airport can roll over (save) the Non Primary Entitlement funds until federal fiscal year 2003 (the end of AIR-21), at which time the accumulated total of rolled-over funds can be used for larger projects. These set-aside funds cannot be transferred to another airport and any unused funds at the end of the entitlement program revert to the FAA. It should also be noted that Paine Field has been designated by the FAA as a "Super Reliever". Although this designation does not appear to offer any advantages with regard to receiving FAA grants at this time (lack of adequate funding in the program), it could in the future.

Although not a funding source available for use at Paine Field currently, it is important to note that, for airports with commercial passenger and/or cargo service, the AIP also provides passenger and cargo entitlement grants for eligible improvement projects. For these airports, funding received is based on a formula using the airport's passenger enplanements and cargo weight, which is reported two years prior to the current grant year. Since the enactment of AIR 21, the minimum amount of this type of entitlement funding for primary commercial service airports is $1,000,000 per year.

AIP Discretionary Grants. The FAA also provides discretionary grants on a 90/10 basis to airports similar to Paine Field. This source of funding is over and above entitlement funding, and is provided to airports for projects that have a high federal priority for enhancing safety, security and capacity of the airport and would be difficult to fund otherwise. The dollar amounts of individual grants vary and can be significant in comparison to entitlement funding. Discretionary grants are awarded at the FAA's sole prerogative. Discretionary grant applications are evaluated based on need, the FAA's project priority ranking system, and the FAA's assessment of a project's significance within the national airport and airway system.

Further, per FAA, discretionary funds are those established in various set-asides plus any appropriated funding remaining after all apportionment funds have been allocated. These funds are assigned at the discretion of the FAA Administrator, to support noise mitigation projects and the highest-priority development that will benefit the National Airspace System (NAS). These discretionary set-aside funds are designed to achieve specific funding minimums for the noise program, reliever airports, and the conversion of military airports. The Capacity/Safety/Security/Noise (CSSN) fund is to be used to preserve and enhance capacity, safety, and security and carry out noise compatibility programs, and include Letters of Intent (LOIs). The Noise funds are used towards FAR Part 150 Noise Compatibility Programs (NCP). The remaining discretionary funding is also referred to as "pure discretionary" and is assigned to projects at the Administrator's discretion.

Passenger Facility Charges (PFC). The Aviation Safety and Capacity Act of 1990 contained provisions for airports to levy passenger facility charges (PFC) of up to $3 per enplaned passenger for the purpose of funding qualified airport enhancement projects. The proceeds from PFCs are eligible to be used for AIP eligible projects and for certain additional projects that preserve or enhance capacity, safety or security; mitigate the effects of aircraft noise; or enhance airline competition. PFCs may also be used to pay debt service on bonds and other indebtedness incurred to carry out eligible projects. Further, the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21) of 2000 modified the current PFC program in several

ways, the most significant of which was the approval to raise PFC collection rates up to $4.50 per enplaned passenger.

The FAA PFC Branch reports that as of May 1, 2002, 330 U.S. airports have been approved to collect PFCs. The PFC Branch further reports that 112 small hub, non hub and commercial service airports have been approved to raise their PFC levels to either $4 or $4.50 per passenger. Paine Field would be eligible to levy a passenger facility charge following the initiation of commercial passenger service at the airport.

FAA Regional Airport Plan. The Regional Airport Plan (RAP) provides a link between national/regional objectives, the FAA Airports Division's five-year plan, and specific decisions associated with the preparation of the Airport Division's Airport Capital Improvement Plan (ACIP) at focus airports (commercial service, certificated, and GA airports with over 75 based aircraft). *The focus of the Regional Airport Plan is on discretionary funding allocated to all discretionary categories within the Northwest Mountain Region.* Since 1997, the Northwest Mountain Region's total AIP has averaged approximately 10 percent of the national funds available and the region's discretionary funding averaged approximately 14 percent of available national discretionary funding. To provide reasonable assurance of needed support, spread over several years, a list of Airport Capital Improvement Projects (ACIP) is maintained in the RAP. Many projects that require major funding expenditures have benefited from the RAP programming approach. The RAP is an important planning tool used by the Region's Airports Division as the best possible estimate of the potential availability of funding and the Region's best forecast of the airport improvement work it can support financially.

Historic Review of FAA Grants Received. Following is a list of FAA AIP grants received in the 10-year period 1990 through 1999. It can be noted that the airport has benefited from improvements that have been primarily funded by the federal government. On average, during the period 1990 to 2002 the airport received approximately $2.4 million per year in AIP grants. There is no guarantee that the airport will continue to receive federal matching funds at the same level it has had in the past. On the other hand, unless the AIP program changes substantially, it is certainly reasonable to assume that the airport will continue to receive some amount of federal matching funds in the future.

Project 3-53-0028-14 (1990). Signage Phase I, security gates, lighting controls. Federal participation - $320,785.

Project 3-53-0028-15 (1991). Taxiway F south construction, Phase II signage. Federal participation - $241,182.

Project 3-53-0028-16 (1992). Signage, Phase III; rehabilitate HIRL Runway 16R/34L. Federal participation - $971,816.

Project 3-53-0028-17 (1992). Master Plan and Environmental Assessment. Federal participation - $200,000.

Project 3-53-0028-18 (1993). Runway 16R/34L and Taxiway Alpha shoulders. Federal participation - $2,732,270.

Project 3-53-0028-19 (1994). Runway 16R/34L resurfacing. Federal participation - $2,300,000.

Project 3-53-0028-22 (1996). Reconstruct Runway 34L. Federal participation - $1,434,147.

Project 3-53-0028-23 (1996). Reconstruct Taxiway A7. Federal participation - $233,853.

Project 3-53-0028-25 (1998). Runway 16R/34L Safety Area Improvements. Federal participation - $4,642,452.

Project 3-53-0028-26 (1998). Runway 16R/34L Safety Area Improvements. Federal participation - $1,495,000.

Project 3-53-0028-27 (1999). Runway 16R/34L Safety Area Improvements. Federal participation - $3,450,000.

Project 3-53-0028-28 (1999). Runway 16R/34L Safety Area Improvements. Federal participation - $3,881,139.

Project 3-53-0028-29 (1999). Runway 16R/34L Safety Area Improvements. Federal participation - $471,976.

Project 3-53-0028-30 (1999). Runway 16R/34L Safety Area Improvements. Federal participation - $3,000,000.

Project 3-53-0028-31 (2000). Master Plan Update. Federal participation - $233,492.

Project 3-53-0028-32 (2001). Rehabilitate Runway 16R/34L Centerline. Federal participation - $360,000.

Project 3-53-0028-33 (2001). Construct Runway 16R/34L Safety Area. Federal participation - $730,076.

Project 3-53-0028-34 (2002). West Ramp Hangar Development. Federal participation - $2,000,000.

FAA Facilities & Equipment Funds. Within the FAA's budget appropriation, money is available in the Facilities and Equipment (F&E) Fund to purchase navigational aids and air safety-related technical equipment, including Air Traffic Control Towers (ATCTs) for use at commercial service airports in the national airport system. Each F&E development project is evaluated independently through a cost/benefit analysis to determine funding eligibility and priority ranking. The qualified projects are totally funded (i.e., 100%) by the FAA, with the remaining projects likely being AIP or PFC eligible. In addition, the airport will apply for NAVAID maintenance funding through the F&E program for those facilities that are not F&E funded. It is possible that some of the proposed navigational aid-related development projects for Paine Field would qualify for F&E funding, if available.

Private Third Party Financing. Many airports use private third party financing when the planned improvements will be primarily used by a private business or other organization. Such projects are not ordinarily eligible for federal funding. Projects of this kind typically include hangars, FBO facilities, fuel storage, exclusive aircraft parking aprons, industrial aviation use facilities, non-aviation office/commercial/industrial

developments, and various other projects. Private development proposals are considered on a case by case basis. Often, airport funds for infrastructure, preliminary site work, and site access are required to facilitate privately developed projects on airport property.

Airport Revenues. At many airport facilities, generating the necessary cash flow to balance the operations and maintenance can be a difficult task. A review of the financial documentation for Paine Field indicates that the airport is operationally self-supporting. The airport is operated as an enterprise department, with its income and expenses held separately from other Snohomish County funds.

As identified in the airport's annual income and expense reports, major sources of revenue for the airport include: airport fees, commercial leases, hangars and tie-downs, utility fees, and fuel fees. Major expenditures include: salaries and wages, personnel benefits, professional services, utilities, supplies, debt service, and repair and maintenance. The following table, entitled *OPERATING REVENUE AND EXPENSE SUMMARY, 1997-2001*, provides the annual totals for operational revenue and operational expense without consideration for depreciation. The conclusion to be drawn with this information is that the airport is operationally self supporting and has generated funds each year from operational activities for capital improvements. During the past five years, the airport had an average annual net operational income of approximately $1,412,000. Capital requirements exceeded net income during this period.

Table F4
OPERATING REVENUE AND EXPENSE SUMMARY, 1997-2001
Paine Field Master Plan Update

Year	Revenues	Expenses	Net Income (Loss) [1]
1997	$6,025,000.00	$4,921,000.00	$1,104,000.00
1998	$6,435,000.00	$5,230,000.00	$1,205,000.00
1999	$6,673,000.00	$5,198,000.00	$1,475,000.00
2000	$7,148,000.00	$5,818,000.00	$1,330,000.00
2001	$7,766,000.00	$5,821,000.00	$1,946,000.00

Source: Paine Field Financial Reports
[1] Actual. Not including depreciation of capital assets.

Generation of money to adequately fund capital costs associated with the operation of an airport is a daunting challenge. Some general aviation airports rely on supplemental money from municipal or county general funds to assist with funding major projects. Snohomish County's general fund does not appear to be able to provide the type of financial assistance necessary to fund the airport's capital needs identified in this Master Plan Update. Careful planning will be required to ensure that the airport's capital needs are met with the scarce dollars that are available.

Summary - Master Plan Capital Improvement Program Financial Implications

The previously presented *DEVELOPMENT PLAN PROJECT COSTS* tables provide a reasonable estimate of the money that will be needed to fund the capital improvement program at the airport. With the best information available today, the tables provide information related to what projects will be needed, when those projects are likely to be constructed, and how the improvements are likely to be funded (e.g., local, federal, etc.). It is realized that the timing for project implementation will change as sponsor and FAA priorities evolve; however, the projections of funding needs are reasonable estimates for long-term capital improvement planning purposes.

The financial implications for financing of airport improvements are probably best summarized in a presentation of the total expected expenditures, broken down by phase and recommended financing method. This information is presented in the following table, entitled *CAPITAL IMPROVEMENT EXPENDITURES BY PHASE*.

Table F5
CAPITAL IMPROVEMENT EXPENDITURES BY PHASE
Paine Field Master Plan Update

Phase	CIP Total Cost	Sponsor Funding	Private Funding	Federal AIP Funding
Phase I (0-6 Years)	$73,185,000	$12,365,000	$36,923,000	$23,897,000
Phase II (6-11 Years)	$110,640,000	$19,903,000	$70,200,000	$20,537,000
Phase III (11-20 Years)	$60,300,000	$6,030,000	$36,000,000	$18,270,000
TOTALS	**$244,125,000**	**$38,298,000**	**$143,123,000**	**$62,704,000**

It should also be noted that projects represented as potentially needed in this *Master Plan Update* are based on forecast demand; only those projects that are required to meet actual demand will be proposed for construction. If demands do not increase as rapidly as anticipated, a number of the proposed projects should be revised, eliminated, or delayed. On the other hand, if demand occurs more rapidly than forecast, the project schedule will be accelerated. The ability to fund projects is also often directly tied to demand.

Because demand and improvement needs can best be defined in the short-term, the Phase I project list is the most comprehensive and is generally the most challenging to finance. As indicated in the table above, Federal funding needs could total as much as $24 million dollars during the five years comprising Phase I and sponsor funding needs could be just over $12 million. If averaged over the five year period, the federal share would be approximately $4.8 million per year and sponsor funding would be approximately $2.5 million per year.

If the average potential federal funding need over the next five years ($4.8 million) is compared with the average annual federal funds that were received during the 1990s ($2.4 million), it can be seen that the CIP detailed in the Master Plan Update represents an aggressive program. Even with the increases in AIP funding over the past few years, Paine Field's needs may exceed the capabilities of the FAA to participate. The Master Plan Update's CIP is also aggressive from a sponsor funding standpoint. This is demonstrated if the average potential sponsor funding need over the next five years ($2.5 million) is compared with the past five year's average annual net operational income ($1.4 million).

Certainly, the capital improvement financial implications of the CIP are significant for Snohomish County and the FAA; yet, they are not unreasonable or unattainable for an airport facility like Paine Field, whose role is regionally, nationally, and internationally critical.

These financial implications also illustrate the need to best utilize the tremendous asset that the airport has in undeveloped land. The use of the undeveloped land in the future will certainly help determine the financial well being of the airport in the future. It is also understood that decisions on how to use these undeveloped lands are difficult, with consideration of many different factors being required. First, in consideration of the need to support its mission as an aviation use facility and to meet its federal grant assurance obligations, the airport land must be used to accommodate potential aviation demands. Secondly, the land must be used to provide income to best support the continued operation and maintenance of the airport. Decisions on the use of airport lands are further complicated by the need to consider potential environmental impacts (e.g., water quality, wetlands, air quality, noise, etc.). As a long-term physical

development plan document, this Master Plan Update provides guidance on how airport land should be utilized in consideration of these complex issues.

Appendix Contents (Click Item to View)

Paine Field Mediated Role Determination

Comment Letters that lead to Revisions of Inventory Chapter

Snohomish County Council Motion No. 01-255

FAA Land Policy 97-02

FAA Dissemination of Revised and New Planning Guidance

Noise Abatement Procedures for All Aircraft

FAA Airport Layout Plan Approval Letter

Air Quality Conformity Analysis

Snohomish County Council Motion No. 02-491